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Electrical World

A McGRAW-HILL PUBLICATION

...vy Saves With 480-Volt Series Lighting

JANUARY 3, 1948

Features

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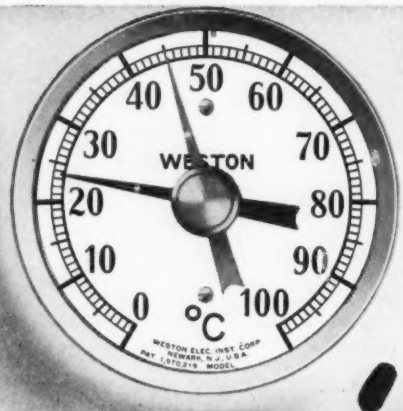
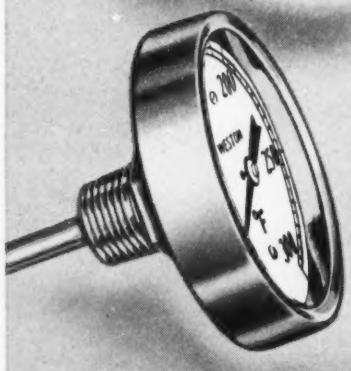
How to Select Sales Personnel
Transformer Temperatures—Graphically
Sporn Station Designed for Low-Cost Operation



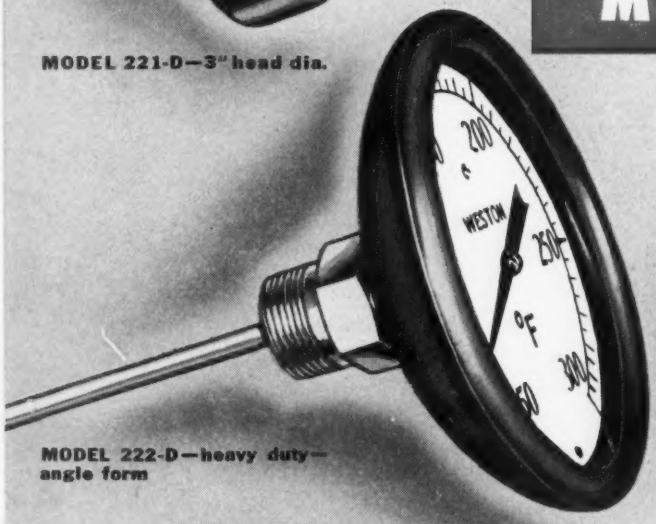
MAX-MIN MODEL—Shows high or low temperatures reached since last setting

it's Weston

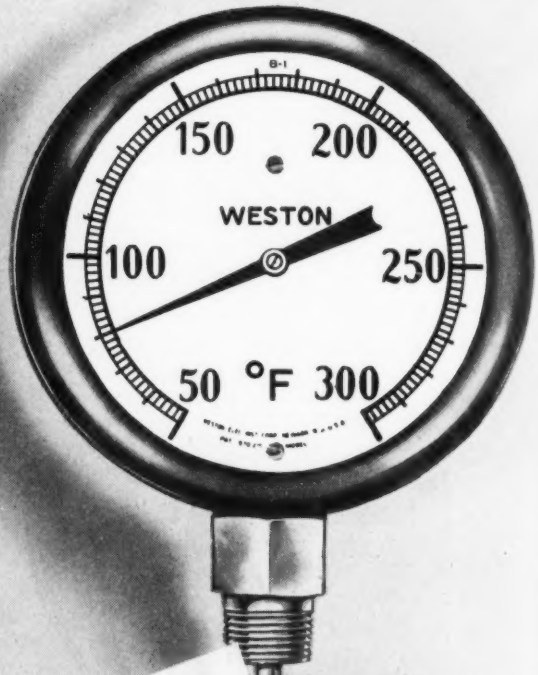
IN TEMPERATURE MEASUREMENT, TOO!



MODEL 221-D—3" head dia.



MODEL 222-D—heavy duty—angle form



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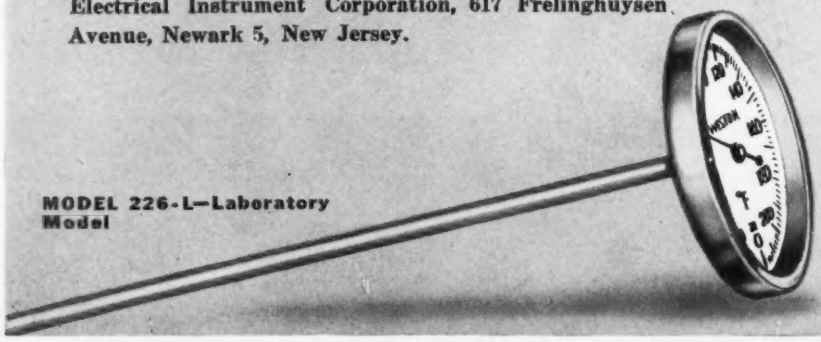

MODEL 226-L—Laboratory Model

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Electrical World

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January 3, 1948

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This Week's Cover Picture

Side-stepping the specific requirements of most safety orders regarding maximum lighting voltage limits, Naval authorities converted this Moffett Field blimp hangar for use in servicing planes of the Naval Air Transport Service. Savings effected by the use of higher voltage reduced installation costs approximately 40 percent. See page 33

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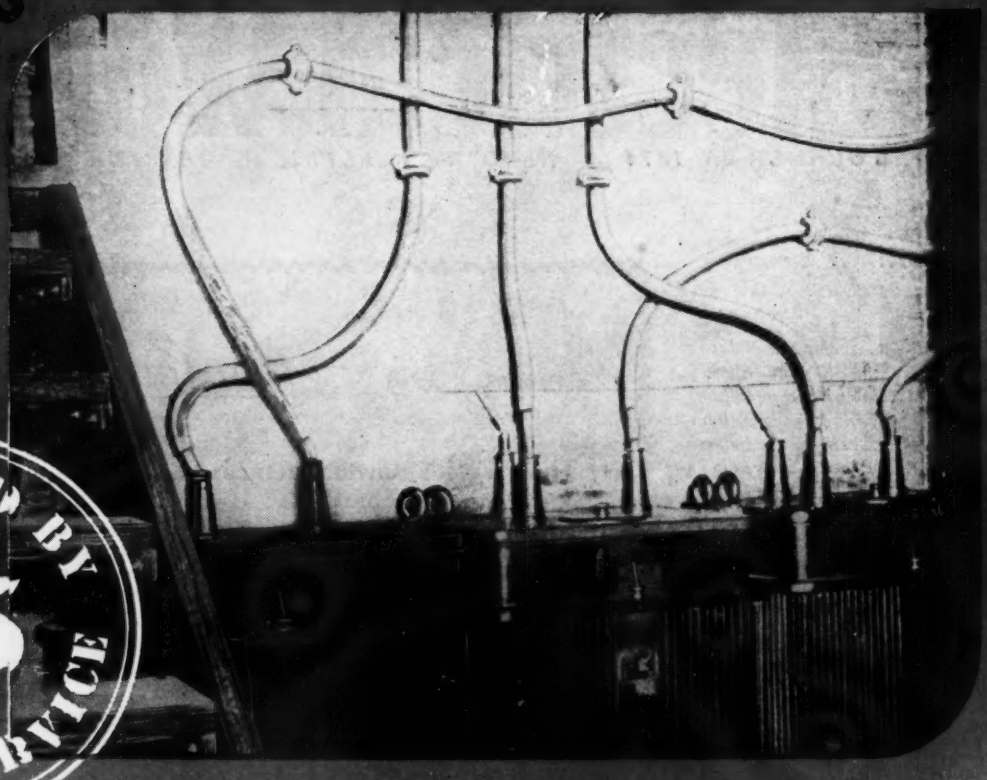
TIME puts its OK on KEYSTONE



PROVED BY 25 YEARS SERVICE

Typical service record of Hazard Keystone Insulation is this 22,000 volt transformer cable installation — no trouble for 25 years . . . no signs of deterioration .

When you are plotting ways and means to keep ozone, moisture and heat from short-changing you in power circuits, remember this concrete example of what you can expect from Hazard Keystone Insulation under such operating conditions — 25 years of trouble-free service and still no signs of insulation deterioration is the history of these 22,000 volt transformer cables installed by an inter-urban electric railroad.

Hazard Keystone Insulation effectively combines in one oil-base compound unusual resistance to ozone, heat, moisture, sunlight, chemicals and acids. It has been used with outstanding success for aerial, underground, interior and submarine circuits with various types of outside protective jackets employed in accordance with the particular job requirements. For all the facts, write for bulletin H-403. The Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

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Electrical World — Editorials

JANUARY 3, 1948

What About Next Year?

THE ARRIVAL of 1948 makes utility executives get to work—hard—on the problems which loom for 1949. From this corner, they certainly look imposing.

Many systems will be adding plant furiously during 1949. That will mean adding furiously to capital for those who have pretty well spent their depreciation reserves and surplus. Immediately, then, the problem of money rates is raised. Will they be higher, lower, or co-equal with 1948 money rates? Right now, the cost of money is rising.

There arises, too, the question of a "capital shortage." Increasingly, although hardly incessantly, one hears that there just may not be enough capital to meet all the demands for it. The quick answer is that no such shortage exists which can't be cured by an attractive interest or dividend rate. This is true, of course. Also, it's an oversimplification. It's one thing to shove along the increased cost of money in a business whose revenues are not limited by regulatory laws. In the utility industry, this operation is not so simple. It is becoming apparent that the people who hire out their dollars are demanding some of the "first, second and third round" gravy which has gone to those who hire out their labor. It's hard to blame the investor for this, but that solves no utility man's problems.

What about rates in 1949? The industry has a proud record of lowering its prices. Yet even today, it faces irresponsible but politically-powerful attack on its rates. Which is more greatly to be feared, political attack or credit impairment? That question is easily answered. But the easy answer brings a new question. Is the industry ready with an effective campaign to demonstrate the validity of increased rates? A lot of unregulated companies which have raised prices have striven hard to demonstrate that they had no alternative. Judging from the public clamor over high prices, these companies haven't made their point successfully. The electric utility industry, then, must do a better job than has yet been done in this regard.

What about ownership in 1949? Measurable progress this year is not to be anticipated. In 1949, it may be possible to achieve some rectification of the wrongs which exist in federal power policy. Is the utility industry ready to do a constructive job on legislation? Has it a realistic concept of what change can be obtained and what can not? Has it achieved a politically realistic attitude? Is it thinking, legislatively, in terms of the good old days or the good new days? Specifically, and by example, is the idea to attempt such an impossibility as gutting TVA, or is it rather to achieve the realistic—say, to realign TVA's accounting so as to show all the facts and nothing but its facts? The one can be sold to Congress. The other can't be.

What about industry public relations? The topic still lies unsolved on the desks of industry leaders. Is the topic to be somebody's theme or an industry program? Is it to be a step-child or a matter of most pressing concern? Is public relations to be a shapeless thing, defined locally, or is it to be an expert job, performed by people who have mastered it? Is it to unite the industry or divide it further?

Any utility executive will be able to add to these problems by the dozen. But those who would be ready to solve 1950's problems a year from now must get at these today.

★ ★ NEWS OF THE

Electrical Manufacturers Get Allocation Assistance

Heavy Power Equipment Included With Four Other Programs In Commerce Department Voluntary Allocation Plan Under Recently-Enacted Law—Conferences Begin Soon On Details

WASHINGTON—Production of electric utility equipment is one of five industrial fields slated for early assistance through voluntary allocation programs. Manufacturers of generating, transmission, and related power facilities probably will be called upon to discuss their production needs with federal officials sometime this month.

Steel industry representatives are scheduled to confer in Washington, Jan 8, with a special staff of the Department of Commerce. The meeting will be preliminary to setting up the voluntary programs approved by Congress during the recent special session. Steel industry people will be asked to cooperate in the voluntary programs (VP-1, VP-2, etc) now planned for the following manufacturing industries: freight cars, farm machinery, electric power equipment, petroleum production equipment, and nitrogen fertilizer.

Industry groups in each of these fields will be asked to meet with government specialists to establish production goals. These goals would be based on essential domestic needs and Marshall Plan requirements. To meet them a production quota will be assigned by the government to each producer in the five industries. The quotas probably will be based on a combination of capacity and past experience.

Commerce Department, which will handle most programs covering industrial materials, is setting up a WPB-type staff for the job. It will be headed by H. B. McCoy, Chief of the Office of Domestic Commerce and of the Office of Materials Controls.

But, under the authority granted the President by Congress, McCoy's staff will have no power to issue directives of the nature issued by the War Production Board. It will merely be able to draw up production scheduled and allocation programs, then request industry cooperation. There is only a remote threat of compulsion in the law enacted by Congress—the President will report non-cooperators to Congress.

The law does permit industry conferences. At the invitation of the government, industries may work out mutually satisfactory means of meeting production quotas without threat of prosecution under anti-trust laws. This might entail agreements among electrical manufacturers, for example, to divide among themselves the total requirements for power equipment.

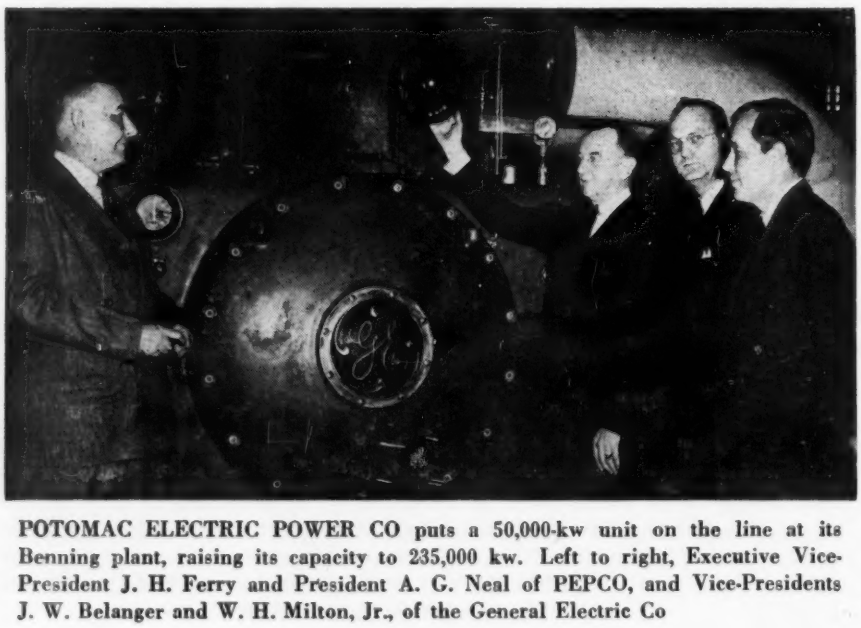
But first, the industry must accept the production goal set for it under the voluntary allocation program. Then, after agreeing on means of meeting this goal, it may submit to the government detailed lists of raw materials and component products it will need.

Then the government will attempt to wrest voluntary agreements from raw material and component product suppliers. These would give priority status to the needs of the VP programs. This will be the toughest part of the government's allocations job. Government can offer no compensating benefits to these producers. And it can only threaten to report non-complying suppliers, to the Joint Economic Committee of Congress.

If agreement can be obtained from suppliers of the VP industries, it is expected that no detailed scheduling of order boards or elaborate priority systems will be needed. Tentatively plans call for procedure along the following lines:

Assume that the electrical manufacturing industry is found to require 10 percent of the total production of a certain gage of steel plate during the second quarter of 1948. All steel-plate producers would be asked to allot 10 percent of their output to the power equipment program. The electrical manufacturer would place orders for plate with his regular supplier. He would certify that his order is needed to meet his VP quota. This certification would insure preferential delivery.

A plate producer already booked up to 10 percent with VP electrical orders could refuse the order. The electrical manufacturer then would shop around for another plate supplier. If he could



POTOMAC ELECTRIC POWER CO puts a 50,000-kw unit on the line at its Benning plant, raising its capacity to 235,000 kw. Left to right, Executive Vice-President J. H. Ferry and President A. G. Neal of PEPCO, and Vice-Presidents J. W. Belanger and W. H. Milton, Jr., of the General Electric Co

not find one to handle his order, he would telephone Washington for help.

The steel industry is crucial to the VP systems. Key shortage in all five industries now scheduled for assistance is steel. But if the steel industry cooperates, it will act as policeman for everyone else. Any steel user who bucks the voluntary plan jeopardizes his preferential supply of steel.

On the other hand, the steel industry bears the brunt of the plan. If the VP plans get more steel for preferred groups, other customers will get less. This will mean more complaints for steel industry sales managers. The government can help only to the extent of asking big steel users, such as the auto industry, to agree voluntarily to order less steel.

Eventually, the VP system may influence some of the manufacturers involved to revamp their production systems. For example, electrical manufacturers now may standardize designs of generators. Under the VP program, manufacturers might agree among themselves to accept no orders for nonstandard generating equipment—a step hitherto forbidden by anti-trust laws.

•

$8,000,000 Plan Proposed for Prince Edward Isle

Plans for an $8,000,000 province-wide electrification program on Prince Edward Island, involving acquisition by the government of all electric plants and their control by a provincial commission, were outlined recently by Dr T. H. Hogg, consulting engineer. The former chief engineer of the Hydro-Electric Power Commission of Ontario included the plans in a report to Premier J. Walter Jones.

Dr Hogg anticipates that ultimately the whole province will be served from one central station, with a tie-line between the two main centers of population and rural lines running from these two centers.

For the immediate future, he recommends the taking over of the Maritime Electric Co plant in its entirety along with other smaller plants.

The proposed electrification program covers a 10 to 15-year period. Of the estimated $8,000,000 total cost, $5,000,000 would be for purchase and construction of rural lines.

NEW PLAZA STORE of the Kansas City Power & Light Co, Kansas City, Mo., occupies 10,800 sq ft of space and features "all electric" living

Record Peak Demands Met, EEI Survey Shows

That the electric utility industry was able to handle successfully the record demands made upon it before Christmas has been confirmed. Edison Electric Institute, in a telegraphic survey, learned that an aggregate nationwide demand of 49,500,000 kw was carried with a margin of reserve capability of 5 percent. This compares with a similar margin of 12 percent in 1946 and 21 percent in 1944. Reserve margin in 1948 is expected to be 8 percent.

Reports covering some 50,000,000 kw out of the national total of 52,300,000 kw showed that at the time of peak demand only a small handful out of 37,000,000 customers had, by voluntary arrangement, their service interrupted or shifted to offpeak hours and that the total amount of this curtailment was only 48,500 kw. This does not include 98,000 kw of interruptible power cut off during peaks. Voltage reductions of 2 to 5 percent, reported in some areas, had an estimated total effect of reducing peak demand by 75,000 kw.

The peak demand occurred Tuesday afternoon, Dec 23, in New England and along the Middle Atlantic seacoast. Farther west and south it occurred earlier in the month.

Despite statements by REA Administrator Claude Wickard warning that a "power shortage" was imminent for cooperatives, the utilities served their co-op customers with all the power needed. With only 24 utilities, serving 32 co-ops, failing to report, EEI reported that all of the remaining utilities (about 500) but one met all the demands of their REA contracts. This company curtailed power 10 percent for two days and 15 percent for three days. Equipment failure and low stream flow were the charge.

The reporting companies accepted 47 additional contracts to supply power to cooperatives and furnished additional power in 18 more instances to municipal plants or smaller companies to enable them to increase the power supply to co-ops. Only three companies involving the supply of five co-ops were unable to accept at once all requests from co-ops for power contracts.

•

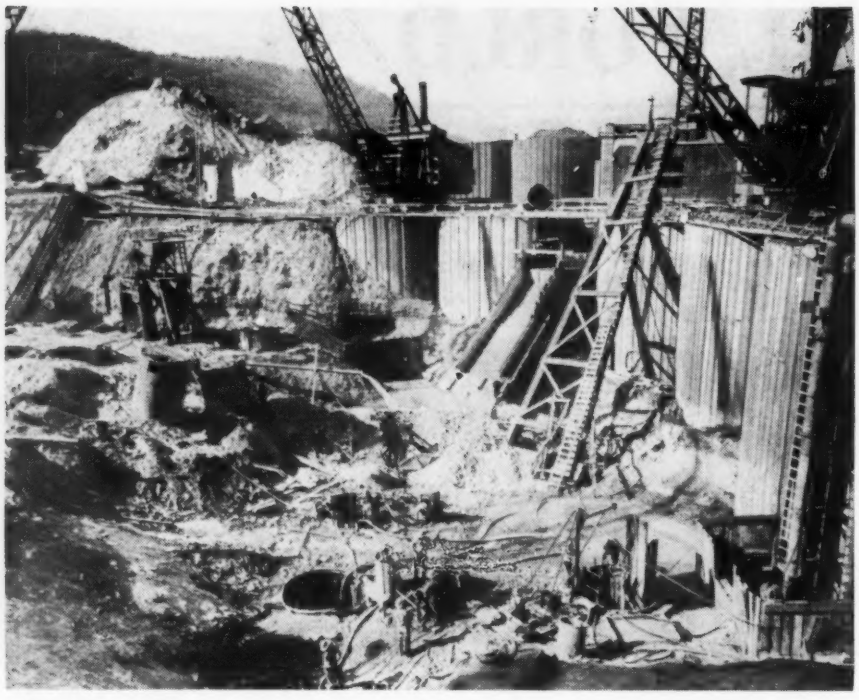
Detroit Edison Co Elects 3 to Vice-Presidencies

Three new vice-presidents of the Detroit Edison Co were announced this week (Dec 30) by President James W. Parker and Chairman Prentice M. Brown.

Walker L. Cisler was raised to executive vice-president from chief engineer of power plants.

James H. Lobban was elected vice-president in charge of all company accounting. He had been secretary and general accountant of the company.

Edward T. Gushee was the third vice-president elected. He has been assistant to the chairman of the board, concentrating primarily on sales, purchasing, and other management affairs.



BEHIND A COFFERDAM holding back the Ohio River, work proceeds on the Toronto Plant of the Ohio Edison Co. In the foreground are four of the holes for the 64 reinforced caissons. They will go down 52 ft to bed rock. Upon them will be built a reinforced concrete floor 8 ft thick. Toronto Plant now has a capacity of 180,000 kw; two 60,000-kw units will be added

British Atomic Pile May Go into Operation in 1948

(McGraw-Hill World News)

LONDON—The high power atomic energy pile to be constructed at the atomic energy research establishment at Harwell, near Didcot, Berkshire, is expected to be in operation about the middle of 1948, G. R. Strauss, Minister of Supply, told the House of Commons recently.

Britain's first atomic pile, a small-scale low-energy proposition, has been in operation at Harwell since late this summer. It is producing "about enough heat to run one electric fire," P. B. Moon, secretary of the Atomic Scientists' Association, disclosed in a recent lecture at Birmingham.

To get a really important contribution to the nation's power supply from atomic energy must take a good many years, Professor Moon said, but there is no practical doubt that it will come in time. Preparations are being made for producing in Britain materials which could be used at will for making atomic bombs or for generating heat.

Meanwhile, a number of British businessmen, who will advise the Government in the industrial application of atomic energy and will be assisting in the construction of the large-scale atomic energy plant at Sellafield, West Cumberland, have been let in on some of the hitherto top-secret information on nuclear fission. The names, however, have not been revealed.

•

Caffrey Lists Important SEC Approvals in 1947

Surveying the list of companies which in 1947 met the requirements of the Public Utility Holding Company Act, James J. Caffrey, chairman of the Securities and Exchange Commission, expressed the belief that all companies will have complied in the near future. He listed the following 1947 approvals as the most important:

Recapitalization of the American & Foreign Power Co, a subsidiary of the Electric Bond & Share Co.

Integration of the American Water Works & Electric Co, under which its water properties were divorced.

Liquidation of two large subsidiaries of the North American Co.

Recapitalization of the Cities Service Co by retiring $59,000,000 of three series of preferred stock on which there were dividend accumulations of $50,000,000.

Recapitalization of the New England Gas & Electric Association.

Dissolution of the Engineers Public Service Co as well as the Midland Utilities Co.

G E Appliance Prices Cut 3 to 10 percent as of Jan 1

General Electric Co began its own price rollback this week (Dec 30). Without affecting charges for capital goods, GE announced reductions of 3 to 10 percent on a broad list of appliances and small electrical equipment. They became effective Jan 1 and are expected to save consumers about $50,000,000 yearly.

President Charles E. Wilson asserted that the reductions, which come "out of profit, are fundamentally sound and ought to be made." The "entire economy," he said, must face up to the fact that stopping the inflationary spiral is the No. 1 job the nation faces.

GE's action, Wilson declared, came without any consultation with any other industry. He made plain his hope that GE suppliers would do the same.

Prices Will Stay Down If—

"We expect to maintain these (reduced) prices, provided no further increase occurs in our own labor costs or in prices of components and materials which we purchase in so great measure from others, and provided there is no further distortion of the material situation through rationing or new allocations. We hope to be able to extend such action to other product lines, as similar action is taken by our suppliers and material manufacturers."

The GE move seemed to put things squarely up to the United Electrical Workers, which represents GE employees. The foregoing statement implies plainly that any third-round wage boost will force GE to rescind its price cuts. Wilson said wage talks could be reopened "almost any time in 1948."

Along with its reductions to consumers, Wilson pointed out, GE is reducing prices to other manufacturers on the stipulated items. These components include fractional hp motors, timers and ballasts for fluorescent lighting. Wilson added that GE would protect retailers and wholesalers on the stocks of reduced goods which they held Jan 1. Such stocks, he believed, are small.

Keying his announcement to the necessity of reducing the inflationary spiral, Wilson said flatly that the GE action is aimed at items which affect the cost of living. He pointed out that in no sense was the reduction an attempt to bolster business. It comes, Wilson said, at a time of peak demand for the reduced goods. In many of these lines, he said, GE could sell all it could produce for months to come at current prices. He found "no sign at all of business slowing up."

Kansas City Utility Plans $22,000,000 Construction

3-Year Program Includes Added Generating Facilities — Intertie to Connect 6 United Companies

The Kansas City Power & Light Co has underway a $22,000,000 construction program to be completed within three years.

Included in the program are appropriations for new generating facilities, a new a-c underground network and modernization of the street lighting system in Kansas City, enlarged facilities to serve industrial customers in the Blue Valley area, extension of rural lines, and its portion of the cost of a 467-mile transmission line linking six utilities.

The new generating facilities will include a 35,000-kw unit, boiler, and auxiliary equipment at the Grand Avenue plant and a boiler at the Northeast plant. Both are in Kansas City, Mo.

A 161-kv transmission line will interconnect six companies of the United Light & Railways System in Iowa, Illinois, Kansas, and Missouri. The line will extend from Davenport, Rock Island, and Moline on the north, westward to Iowa City and Des Moines, southwest to Clarinda and south to Maryville, St. Joseph, and Kansas City. KCP&L will have 50 percent of the capacity represented in the power pool and will be in a position to supply power to the entire area.

KCP&L is responsible for building three sections or 150 miles of the line. These will run from Kansas City to St. Joseph, already in operation, from Kansas City to Paola, and from Paola to Moran. It will also build three substations, at the Northeast plant, in the Blue Valley area to supply major industries, and near Paola.

Seven automatic substations will also be erected in Kansas City to step down power for distribution lines in that city.

Under a contract with the city, the utility is carrying out a five-year program of gradual modernization of Kansas City's street lighting. This will apply throughout the city.

Another major improvement in the city distribution system is the replacing of the old dc Edison underground system with an ac network serving the downtown section and the Country Club Plaza. This project will not be completed until 1952 and will provide a capacity of 41,500 kva at a cost of $2,800,000. The new network involves installation of 150 transformer vaults. The new system will make five power sources available, each having more than double the capacity of the present circuits.

In the Blue Valley area where such firms as Sheffield Steel Co, Ford Motor Co, and Butler Manufacturing Co have located, a substation is being built and the distribution system enlarged. These improvements will make it possible for these industries to secure power from the 467-mile interconnection.

Early in 1946 the utility started a rural program to bring electricity to some 5,000 farms in Kansas and Missouri. Of these 3,835 are now being served, and 800 miles of line have been constructed.

SOUTH portion of the Allatoona multi-purpose dam near Cartersville, Ga., showing penstocks for the power units under construction. There will be three large penstocks of approximately 20 ft, and a smaller one for the station service unit. Two 36,000-kw and a 2,000-kw unit will be installed

The Cost to Kansas City P&L

Generating Facilities	$7,720,458
Interconnections, Lines, Substations	4,030 006
Street and Traffic Lights	820,238
Substations in Kansas City	2,573,033
Improvements for Industrial Customers	304,159
New ac Network	2,800,000
Underground Network Extensions	53,000
Rural Construction	3,700,000
Total	$22,050,894

•

Local 248 Yields to UAW

Officers of Local 248, United Auto Workers, have yielded to Duane Greathouse, administrator appointed by the UAW. The local, whose members are employed by the Allis-Chalmers Manufacturing Co at its West Allis Works, has surrendered its offices and books to Greathouse.

Wisconsin PSC Approves Stand-by Dimout Order

MADISON, WIS.—Drought-born rationing of electric power was legalized in parts of Wisconsin last week (Dec 27) by Public Service Commission action. The "stand-by," non-mandatory order authorizes Wisconsin Public Service Corp and its subsidiary, Menominee and Marinette Light & Traction Co to:

1. Require commercial customers to cut show window, exterior, marquee, decorative, flood light, and sign lighting demand by 50 percent. Also, it may make sizable reduction in interior lighting.

2. Require industrial customers to spread out work and thereby reduce peak loads.

3. Disconnect completely service to any customer who intentionally violates provisions of the order.

4. Cut street lighting by operating only all-night circuits.

5. Reduce voltage up to 5 percent at the bus.

6. Interrupt service on circuits up to a two-hour period. (These must be on a pre-arranged schedule and after adequate customer warning.)

PSC ordered that the program be applicable only to central and northeastern Wisconsin. It does not apply statewide.

J. P. Pulliam, WPS president, told ELECTRICAL WORLD that "all this order does is clear the atmosphere. It might

MEMBERS of the United States National Committee of the International Commission on Illumination at their recent meeting in which they discussed American participation in the first post-war ICI meeting at Paris next July

be considered a stand-by order. We now have legal authority to take specific steps if and when they are needed. We will invoke these only as a last resort."

Pulliam said also that there has been "no material change in available capacity since November." Then, WPS told the PSC that drought was causing a serious capacity situation. It requested authorization for emergency programs, which led to last week's order.

Pulliam said that capacity, while tight, is not critical. It will not become critical, he added, without an outtage on a major generating unit. Pulliam said that, even before the PSC order, WPS had been conducting a conservation campaign. Cooperation he described as "splendid," with the peak reduced by about 10,000 kw even during the holiday period.

The WPS program urged:

1. Spreading of washing and ironing load throughout the week.
2. Reduction of industrial peaks by night and week-end shifts.
3. Emergency purchases from non-utility sources.

This program has been ordered continued by PSC.

•

Hearings Recessed

The Ohio Public Utilities Commission has recessed until Jan 12, two cases involving the Cincinnati Gas & Electric Company (*EW*, Dec 20, Page 48). The cases are appeals by the company against gas and electric rate reductions.

•

Gets 25-Year Franchise

Gulf Public Service Co has secured a 25-year franchise at Crowley, La.

6 Americans Will Present Papers at Paris Meeting

Six Americans will present papers at the first post-war meeting of the International Commission on Illumination. The meeting will be held in Paris during the first week in July.

At the recent meeting of the United States National Committee to make plans for American participation, George H. Stickney, who has served the committee as secretary for nearly 20 years, was elected honorary president. Preston S. Millar, Electrical Testing Laboratories, Inc, was elected president. Carlyle A. Atherton, Reynolds Metal Co. is vice-president, and Arthur A. Brainerd, Philadelphia Electric Co, secretary-treasurer.

These papers will be presented at the Paris meeting by their authors: "Architectural Lighting," H. E. d'Andrade; "Fundamental Concepts of Quantity of Light and Quality of Lighting," Matthew Luckiesh; "Comfortable Lighting as Determined by Discomfort Glare Ratings," Ward Harrison—all of General Electric Co. "Economics of Light Sources as Seen in the U. S. A.," R. G. Slauer; "Fluorescent Lamps and Operating Devices," R. M. Zabel—both of Sylvania Electric Products, Inc; "Bactericidal Lamps and Their Use," S. G. Hibben, Westinghouse Lamp Co.

•

City Wants Plant Profits

So as to make the profits of its municipal electric and water plant available for general municipal purposes, the City Council of Jonesboro, Ark., has voted to take over control on March 1, 1948. The system is now administered by a board of directors separate from the city administration. All profits remain with the utility. Some opponents of the move threaten court action. Others are circulating petitions for a city wide vote in April.

•

Kentucky Co-ops Set Up State Office at Louisville

The Kentucky Rural Electrification Cooperative Corporation will open a state office at Louisville in January. J. K. Smith, manager of the Fleming-Mason Rural Electric Cooperative, Flemingsburg, will be executive manager.

The state office is being set up to conduct on a centralized basis many of the activities now carried on locally by the various co-ops. Among these activities are:

1. Group purchasing of materials and supplies.
2. Central billing of electric accounts.
3. Assistance for legislative program for all co-ops.
4. Conducting a training school for employees.
5. Publication of a state monthly newspaper.

Co-ops now serve 72,000 customers and expect to have 120,000 by the end of 1948.

•

Bids for 7 Small Utilities

Dayton Power & Light Co has submitted a bid for an undisclosed amount for the purchase of seven small subsidiaries of the United Public Utilities Corp. The companies furnish service to 24,000 consumers in southwest Ohio. DP&L would integrate the properties into its present system. The headquarters of all of the companies is at Greenville.

BLS Allows 1,200 Kwhr in 'City Workers Budget'

The "city workers family budget" prepared by the Bureau of Labor Statistics for 34 large cities allows 1,200 kwhr of electric power a year for each family in all cities except three.

The three are Jacksonville, Fla.; Portland, Ore.; and Seattle, Wash.; where, BLS says, "Electricity is the predominant type of fuel used for cooking and hot water heating." In these cities, BLS allows in addition 3,360 kwhr of electricity in place of 235 therms of gas, making a total of 4,560 kwhr.

Cost of electricity is figured in the cost of housing for the average family of two parents and two school-age children. BLS used actual electricity prices in the various cities in determining the cost of 1,200 kwhr, which covers "light ing, refrigeration and electrical appliances." Except in the three cities mentioned, the survey applied the cost of gas to cooking and hot water heating expenses.

The standard of living used as a yardstick by BLS provides for a five-room house with electric lighting equipment installed in each room, a mechanical refrigerator, a washing machine, a gas or electric cooking stove, and other appliances.

The percent of original cost of electrical appliances which the city worker's family spends each year is also included in the budget. Averaged out among all families, including those which don't have some items, such as an ironer or sewing machine, the percent of cost each year for each item is reported by BLS to be:

Lamps, 20 percent; iron, 9; washing machine, 7; stove, refrigerator and vacuum cleaner, 6; toaster, 4; fan and waffle iron, 3; ironer and sewing machine, 1.

•

Ungava Power Co Plans 385,000-Hp Hydro Plant

A new light, heat, power, water, and waterworks company has been incorporated in Quebec under the name, Ungava Power Co. The new firm will have its headquarters at Montreal and will operate in New Quebec. Capital stock of $1,000,000 will be divided into 1,000 shares of $1,000.

It is understood that the company will ask the coming session of the Quebec Provincial Legislature for permission to build a hydroelectric power plant on the Kaniapiskau River in New Quebec. The proposed plant would have a capacity of 385,000 hp.

A. W. ROBERTSON, chairman of the board of the Westinghouse Electric Corp, presents certificates for $200 scholarships to six teen-age winners in the 4-H Better Methods Electric Contest sponsored by the Westinghouse Educational Foundation. Left to right: Robertson; Kenneth T. Bosley, Sparks, Md.; Laura F. Sperry, Helena, Mont.; Orville Beyea, Clyde, N. Y.; Charlotte Thurston, Tucson, Ariz.; Gayle West, Memphis, Tex.; Howard Mills, Indianapolis.

Commission Stands Firm; Utility-to-Utility Sale OK

The South Carolina Public Service Commission has stood by its ruling that the South Carolina Power Co may be sold to the South Carolina Electric & Gas Co (EW, Nov 15, Page 20). The Commission last week concluded hearings that lasted three weeks to determine if the sale was in the public interest.

Opposition to the sale began when the offer of the Santee-Cooper Authority was rejected because of the many uncertain legal and other technicalities. Santee had offered $11,600,000 for the properties. Commonwealth & Southern Corp accepted $10,200,000 from South Carolina Electric & Gas, being sure that once the Commission and the SEC approved the sale, payment would not be delayed.

When it became apparent that the opposition, led by public power advocates, was making little if any progress with their arguments, R. M. Jefferies, general manager and general counsel for Santee-Cooper, proposed that the Authority would withdraw its opposition to the sale provided South Carolina Electric & Gas would agree to an immediate 10 percent rate reduction in South Carolina Power territory and to sell the rural lines and distribution systems to rural electric cooperatives and municipalities who might wish to purchase them.

This proposal received no response from the utilities. However, President S. C. McMeekin of Electric & Gas had previously testified that the company would not sell parts of the system.

Before the sale was consummated by Commonwealth, Santee-Cooper had announced plans to purchase the Charleston utility. There were indications also, in some quarters that a state-owned TVA system would spring up with connections with the government's multi-purpose Clark Hill project now under construction near Augusta, Ga., on the Savannah River.

Maintenance of utility operations as a free enterprise shuts off expansion of the state-owned Santee-Cooper Authority in territory now served by the Charleston utility. It also means that the privately owned utility systems in South Carolina and Georgia afford a ready market for all the power which will be generated at Clark Hill.

•

Co-op Refused Territory; VEPCO Service Ordered

The Chickahominy Electric Cooperative and the Virginia Electric & Power Co both lost decisions recently (Dec 19) in their battle over territory in the Tidewater section of Virginia.

The Virginia Corporation Commission refused approval to the co-op to borrow $279,000 from the Rural Electrification Administration to establish service in James City, Charles City, Hanover, and New Kent Counties.

VEPCO was ordered to provide service not only to 12 James City County petitioners but also to "all other persons, natural or artificial," living in the territory lying between the James River and the Pamunkey and York Rivers.

First Iowa Hydro Granted Cedar R. Project License

First Iowa Hydro Electric Cooperative finally won its six-year fight for power development on the Cedar River recently. The Federal Power Commission wound up an extended investigation by issuing the co-op a 50-year license for the project, plans for which include installation of a 50,000-kw hydro generating plant.

But even final approval by the Commission was not without strings. Within nine months, First Iowa must obtain approval of the project plans by the Army and Chief of Engineers as to the effect of the construction upon navigation. In the same period, the co-op must complete arrangements for financing the development to FPC's satisfaction.

The co-op first filed for a federal project license in August, 1941. Despite consistent opposition of Iowa State officials and property owners of the project area, it took its case to the courts when the application was dismissed by FPC. The commission ruled that the co-op failed to comply with state laws.

When the Supreme Court held, in effect, that a federal license would have precedence over state requirements and remanded the case to FPC, the Commission opened new hearings in September, 1946.

State officials and other opponents argued that the project, as planned, would be unsafe and that power benefits would not be commensurate with the cost of construction. FPC rejected both contentions. On the basis of studies by its own engineers and recommendations by the Chief of Engineers, which were incorporated by the co-op in amended plans, the commission held that the project could be made safe. Its opinion noted that the co-op could not obtain "definite financial commitments" until initial authorization of a license had been granted.

•

Interstate Power Finance Problems Eased by SEC

The Securities and Exchange Commission moved this week to ease the financing difficulties of the Interstate Power Co, Dubuque. It approved an alternate recapitalization plan and waived the necessity for competitive bidding on the issues proposed under the plan.

SEC's action followed two unsuccessful attempts earlier this year to sell Interstate common stock, along with bonds. In the first, no bids were received for the company's common stock. In the second, an acceptable bid was disapproved by SEC as representing too great a spread between selling price and the price the company received.

Under the new plan, Interstate will issue $20,000,000 in bonds, $5,000,000 in not-to-exceed 20-year debentures, 1,500,000 shares of $3.50 per common and $1,000,000 in promissory notes. SEC reserved decision as to price, interest rate, spread, and other terms of the proposed securities.

$2 Billion in 1948

Electrical industry men are vitally interested in the 1948 utility budget, and well they should be. It's going to run close to $2 billion—far and away the largest in the industry's history. To get a complete story on exactly how much it will be, what it's to be spent for, and generally where, don't miss ELECTRICAL WORLD's Annual Statistical Issue. It'll be out Jan. 17. And there'll be a lot more than budget in it.

•

25-Year Franchise Voted

Vicksburg, Miss., citizens have voted 792 to 31 to ratify a 25-year franchise granted the Mississippi Power & Light Co by the mayor and Board of Aldermen. The franchise is non-exclusive. The utility will pay a 2 percent tax to the city on all revenue from commercial and residential customers.

•

IBEW Loses in Virginia

Office employees of the Appalachian Electric Power Co, Roanoke, Va., have rejected the International Brotherhood of Electrical Workers, AFL, as their bargaining agent. The vote in the NLRB supervised election was 267 to 74 against the union.

MEETINGS

Previously Listed

Canadian Electrical Association—Winter Conference, Chateau Frontenac, Quebec, January 12-18.

American Institute of Electrical Engineers—Winter General Meeting, William Penn Hotel, Pittsburgh, January 26-30.

Missouri Valley Electric Association—Power Sales Conference, President Hotel, Kansas City, Mo., February 5-6.

Edison Electric Institute—Meter and Service Committee, Joint Meeting with the AEIC Committee on Metering and Service Methods, Biltmore Hotel, Oklahoma City, Okla., February 9-11.

SEC RULINGS

UNITED LIGHT & RAILWAYS Co has received approval of its request to renew its $25,000,000 outstanding 2 percent unsecured promissory notes, maturing Dec 10, 1947, for 3 consecutive periods of one year each. The extension is pursuant to terms of an amended bank loan agreement under which the notes are renewable at the option of the company. (Release No. 7900).

CENTRAL POWER & LIGHT Co has been authorized to sell at competitive bidding $6,000,000 of first mortgage bonds and 40,000 shares of $100 cumulative preferred stock. Proceeds from the sale of bonds and stock are to be used for retirement of $1,200,000 of short-term bank loans and for construction purposes. The company is a subsidiary of Central & South West Corp. (Release No. 7901).

LOUISIANA POWER & LIGHT Co's proposal to depart from the commission's policy of limiting premiums on the issuance of new securities to 2¾ percent of par in connection with its forthcoming issue of preferred stock, has been approved. Louisiana plans to fix the dividend rate on a new issue of preferred stock so as to produce an initial market price of at least $110 a share. Through the new issue, the company intends to retire all of its outstanding $6 preferred stock on a share-for-share basis. Any shares of old preferred not exchanged will be redeemed with the proceeds from the sale of additional common stock to the Louisville's parent, Electric Power & Light Corp. The company's request for an exemption from competitive bidding was rejected, but the commission said that it will consider such a request when the record is completed and the new preferred stock is ready for sale. (Release No. 7906).

MIDDLE WEST CORP AND HALSEY, STUART & Co, INC, have been granted permission to acquire their proportionate shares of 430,000 additional shares of $10 par value common stock of Central Illinois Public Service Co, which the company proposes to issue and sell to them at $10 a share. The commission also granted the application of Halsey, Stuart & Co for an order exempting the company from provisions of the Holding Company Act until March 31, 1948, or the date on which Middle West disposes of its interest in Central Illinois, whichever is earlier. (Release No. 7912).

•

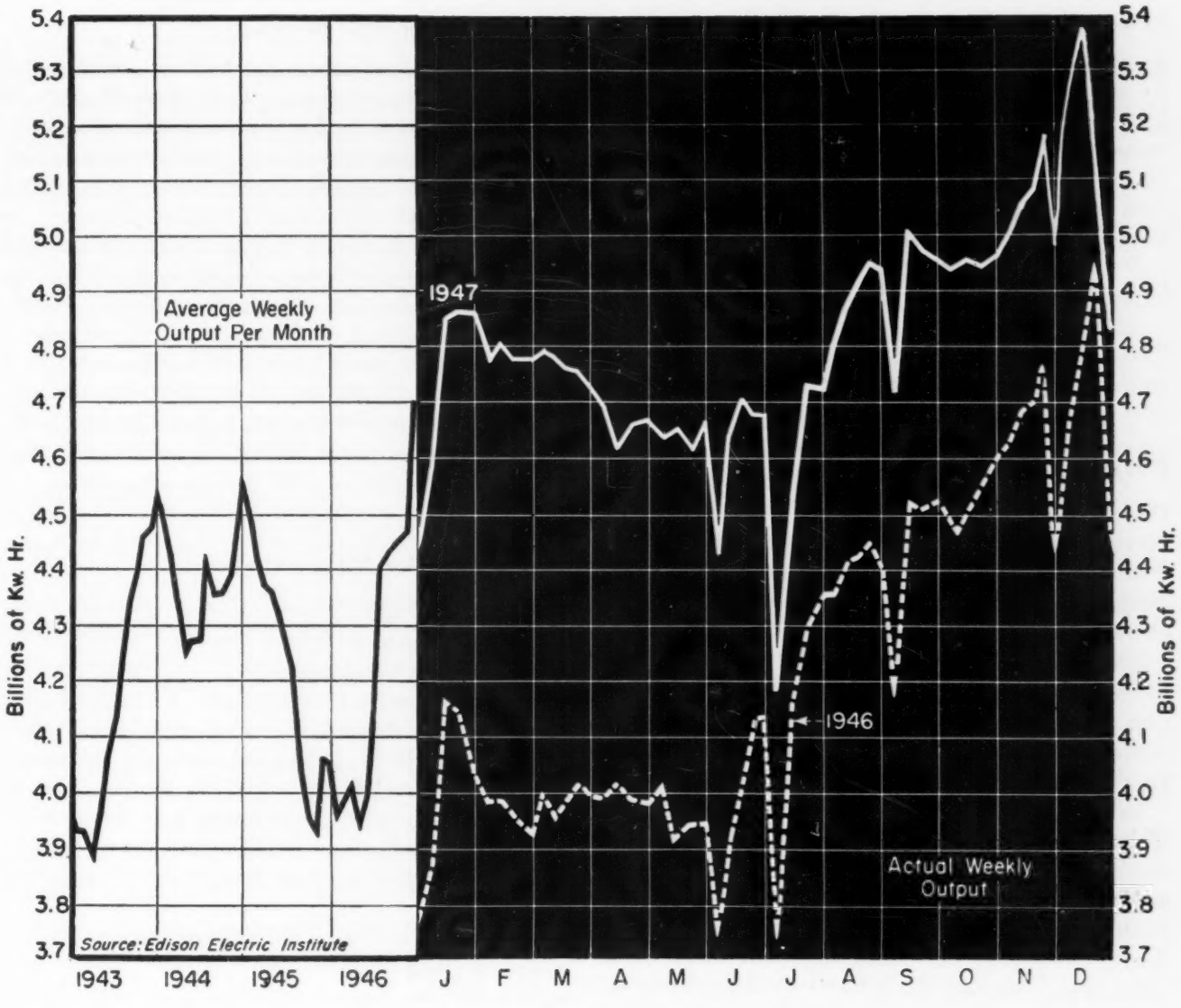
Quits Tennessee PUC

Leon Jourolmon, Jr, a member of the Tennessee Railroad and Public Utilities Commission since 1936, has resigned to establish a law practice in Nashville.

•

5% Utilities Bill Tax

Roanoke, Va., effective Jan 1, will tax all electric, gas, and telephone bills 5 percent.



3 Co-ops End Effort to Buy Missouri Edison Co Lines

Three rural electric cooperatives finally have given up efforts to purchase transmission and distribution facilities of the Missouri Edison Co. Instead, one of the distribution co-ops will expand its own facilities.

Last May the co-ops—Consolidated Electric, Ralls County Electric, and Cuivre River Electric—proposed to buy 179 miles of transmission and 865 miles of distribution lines from Missouri Edison. A new operating cooperative would have been established to take over the transmission facilities.

So certain of their plans were the co-ops that they obtained a $3,898,000 loan from the Rural Electrification Administration to purchase the Missouri Edison properties. Of this total $435,000 was borrowed by the Consolidated Electric Cooperative to finance its share of the acquisition.

Though the co-ops announced they had a "definite commitment" for purchase of the Missouri Edison properties, the deal fell through. The $435,000 loan, plus an added $130,000 granted by REA, will be used by Consolidated Electric to carry out "new construction, mostly of distribution facilities," according to REA.

•

Arkansas Utility Transfer

Arkansas Power & Light Co has taken over the Elaine (Ark.) Utilities Co which serves a number of small Phillips County communities.

Other News

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Output Drops Sharply

Following the usual seasonal trend, the electric output curve moved sharply downward during the week ended Dec 27, 1947, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power companies totaled 4,829,579,000 kwhr, comparing with 5,367,624,000 kwhr during the preceding week. During the comparable week of 1946 the output amounted to 4,442,443,000 kwhr, this year's figure representing an increase of 8.7 percent.

Weekly Output, Millions Kwhr

1947		1946		1945	
Dec. 27	4,830	Dec. 28	4,442	Dec. 29	3,759
Dec. 20	5,368	Dec. 21	4,940	Dec. 22	4,239
Dec. 13	5,327	Dec. 14	4,778	Dec. 15	4,154
Dec. 6	5,218	Dec. 7	4,673	Dec. 8	4,097
Nov. 29	4,933	Nov. 30	4,448	Dec. 1	4,043
Nov. 22	5,180	Nov. 23	4,765	Nov. 24	3,841

Percent Change from Previous Year

	Dec. 27	Dec. 20	Dec. 13
New England	+ 9.1	+ 6.8	+ 9.3
Mid-Atlantic	+ 8.3	+ 6.6	+10.6
Central Industrial	+ 8.9	+10.4	+13.7
West Central	+10.7	+11.9	+14.5
Southern States	+ 9.2	+ 7.9	+ 9.8
Rocky Mountain	+12.2	+10.0	+12.0
Pacific Coast	+ 6.3	+ 7.9	+10.5
Total United States	+ 8.7	+ 8.6	+11.5

Electrical World

OPINION

Help Where It's Needed

THE SERIES of conferences which Irving Trust Company is holding for electric utility executives is meeting a gratifying response from the industry. This isn't surprising. The series attempts to help utility men in a field where more and more help will be needed—financing.

It is apparent that such help is likely to be welcome. Increasingly, operating companies are being set loose on their own. And increasingly, the need for raising new capital confronts utility executives who are expanding their systems as rapidly as possible.

Irving Trust's timely series is the work of Tom P. Walker, former president of Gulf States Utilities Co, of Beaumont, Tex. It isn't the first job he has done for the industry. During the war, he headed the Council of Electric Operating Companies, in Washington. This agency did a good job within the severe limits of its assignment. Recalling that job, it isn't surprising to see Walker back in business at the old stand—help where it is needed.

Substation Individuality

DESPITE PROGRESS in coordinating substation design, marked differences persist in equipment and layout. This is a result of engineering and operating development. Men responsible for maintaining substations find them decidedly individual, even on a single utility system.

The time is ripe for engineers to consider the merits of developing operating and maintenance standards, techniques and instructions for servicing substations.

While general instructions are still useful, specific instructions are coming to the front. They cover the handling and maintenance of every piece of equipment in the sub. Circuit breaker parts, bushings, relays, instruments —everything will be specified on records. Check cards for inspection will avoid omissions when a new foreman takes over. And, as components of any sub change, so will the records. Improved operation of equipment is bound to follow such a step.

And They're Still Wrong

NOT LONG AGO, the Brookings Institution published a tiny booklet entitled "Forecasts Which Went Wrong." It explained, in something less than a shamefaced manner, how so many people went so wrong on that forecast about 8,000,000 people being unemployed a short time after V-J Day.

It may be that Brookings long since published a similar explanation of how its Dr Louis Marlio went so far wrong on his 1942 predictions as to war power supply. Marlio, it will be remembered, was among those who foresaw a 1943 peak load of about 43,000,000 kw, when actually, it reached only 37,252,000 kw. If Brookings has any published explanation of this error, it would be nice to see a copy, as long as ancient history is the order of the day.

Sauce for the Ratepayer

NEW YORK STATE'S Gov. Thomas E. Dewey has demanded an end to the federal income tax discrimination between taxpayers in states which do and states which do not have community property laws. We applaud Gov. Dewey for this interest in his constituents. If advantage under law is to be enjoyed by any citizen, let that advantage be enjoyed by all. In view of Mr. Dewey's devotion to his citizenry, we feel sure that he'll be interested in other ways of protecting them. For instance, we feel certain he'll want them to get all the breaks coming to them on utility rates.

At present, New York State residents pay more federal income tax than any other state's citizens. Part of their taxes go to interest on federal debt. Part of the federal debt is represented by the investment in the TVA. TVA pays interest only on about $60,000,000 of its entire power investment, which runs between $350,000,000 and $400,000,000. The interest TVA pays on its bonds is less than the U. S. government pays on the money it borrowed to buy those bonds. So, all in all, TVA pays far less interest on its power investment than it would had it borrowed that money from anyone other than the U. S. government. New York staters, of course, are paying part of the cost of TVA service every time they pay a dollar in taxes to the U. S. Government. On that basis, Gov. Dewey doubtless will find good reason to ask that this discrimination against New Yorkers be ended.

There's another place where Gov. Dewey can be conscientious about equal advantages under law. He has endorsed the construction of the St. Lawrence Seaway and power project. If and when the New York State Power Authority takes over St. Lawrence output, the least Gov. Dewey can do is make certain that the full costs of that power be borne by the users. In that event, he would not be endorsing a situation where taxpayers in, say, Ohio, would pay more money so that New Yorkers might enjoy interest-free power. It's a real item, this interest-free

arrangement. In TVA's case, it amounts to perhaps $8,000,000 yearly.

And finally, if he really wants to lower the tax burden, as well as merely equalizing it, Gov. Dewey will see to it that the St. Lawrence energy is distributed, under strict regulation, by tax-paying companies. This would let the St. Lawrence power operation pay taxes, which it won't do if publicly handled. It would also reduce the amount of money the government will have to spend—either on capital structures or on debt service—to achieve development of its resources.

There's nothing new about all this, Governor. It's all been said a million times before, and it's all true. It's just been pretty widely overlooked. It might cost you votes to attempt it, but it will save your citizens money. Perhaps more important, it will make for equal advantage under law.

Fuel Oil Trend

To get a current picture of the petroleum situation, it is not necessary to resolve or even raise the issue about the amount in the ground and how much of it is economically extractable. At the moment, the means of transporting oil to the market is the reputed bottleneck, at least in the eastern half of the country. That will pass in due course, but it will leave behind a factor which is so important that it cannot be ignored by the power industry.

This is that progress in the art of refining has steadily increased the yield of the lighter fractions at the expense of the heavier residuals like fuel oil. The cry at first for more and more gasoline, and more recently, for higher and higher octane ratings, has taken its toll from the fuel oil output. Further improvement of conversion and refining techniques could, in another decade or two, easily reduce the residual fuel oil fraction to substantially less than half its present portion.

Power companies take less than 10 percent of the fuel oil output, so there appears to be little they could do in the direction of regulating their consumption to affect the price. The price seems certain to be affected adversely as the inroads of the light-gravity fuels intensify. Price ratio to coal is already 2 to 1 or worse on a Btu basis. Any further distortion would tend to restrict the use of fuel oil to supplemental or emergency needs.

Escape from rising costs for both coal and oil, if there be any, lies in two principal directions. One is to take advantage of every gain in combustion efficiency and every gain in the thermodynamic conversion from mechanical to electrical power—just short of unprofitableness of investment. The other is to design for complete flexibility in day-to-day use of fuel. That would permit taking advantage of price differentials as well as provide defense against stoppages in either industry.

WASHINGTON COMMENT

W. B. WHICHARD

FINANCING of the federal Reclamation program may well be one of the most important issues before Congress during the next session.

Organized western groups, with important backing from the Administration, are clamoring for more "efficient and expeditious" scheduling of Reclamation projects. They want guarantees of a continuous flow of funds sufficient to keep project construction at top speed. The President reportedly will support this demand in his forthcoming budget message and, at the same time, ask for a record annual appropriation for Reclamation.

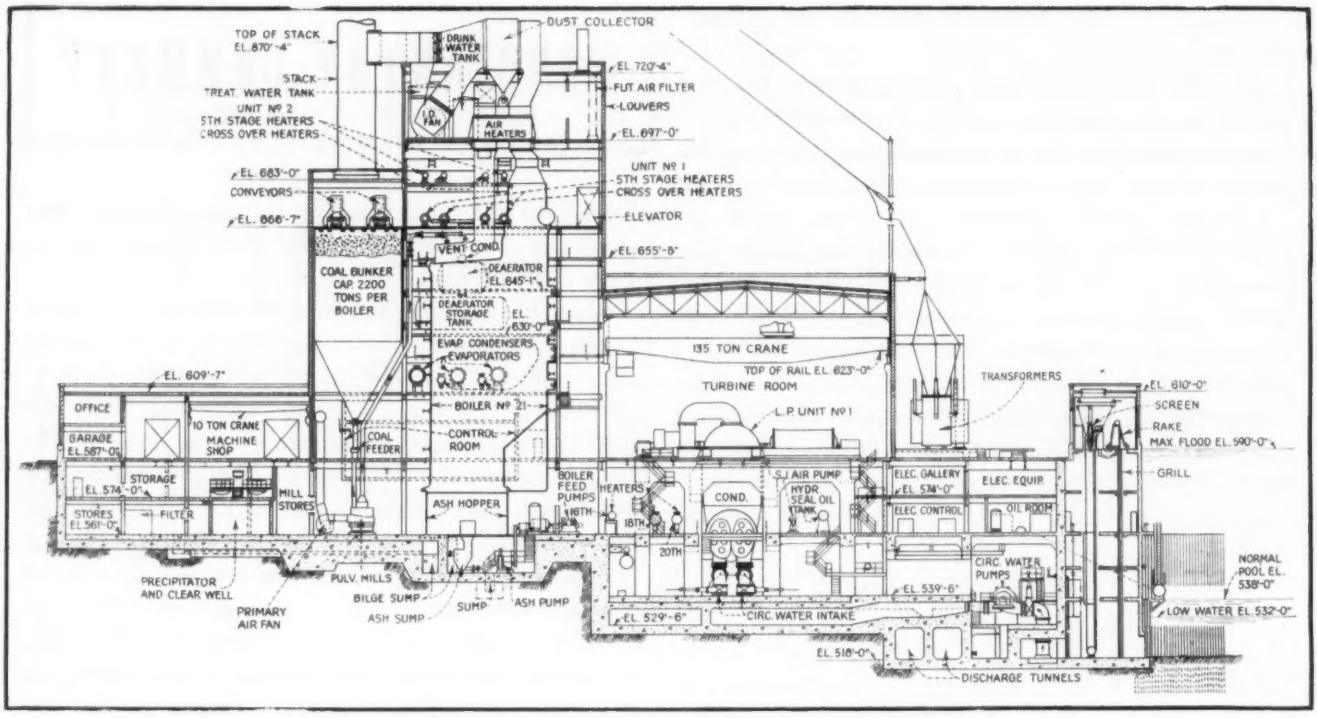
On the other hand, the economy-minded majority of the Congress already is actively unhappy over the prospect of a federal budget carrying unprecendented sums for foreign relief and other urgent requirements. A potent bloc, led by Messrs. Bridges, Taber and Knutson is sticking to its demands that federal spending be cut in order to make tax reductions possible.

This group has given freshman Sen. Harry Cain considerable encouragement in proposing that Reclamation be financed by special federal bonds, to be sold to the public, rather than through Congressional appropriations. At their behest, the appropriations committees began studying means of putting such a plan into operation.

Sen. Cain himself is the first to admit that the idea contains a number of "bugs" and that it already has met objections. In fact, he has abandoned his original idea that all projects listed by the Reclamation Bureau as "self-liquidating" could be financed in their entirety by bond sales. A review of the Bureau's list convinced him that few, if any, multiple-purpose Reclamation works offered hope of anything approaching 100 percent payout. Federal contributions for flood control, navigation and other "non-reimbursable benefits" simply are too large to be absorbed by power and water users. Too large, at least, to be met by power and water revenues at rates now charged by the Bureau.

Irrigationists also complain, with some justification, that they should not be forced to participate in any bond plan. Federal irrigation works traditionally have been built with the understanding that water users would repay the costs without interest.

The Reclamation Bureau's views will be interesting—if not particularly helpful—in working out the Cain plan. For years, the Bureau and its more vociferous advocates have been extolling the "self-liquidating" virtues of the more important of their projects. If nothing else, the debate in Congress over the Cain proposal should make clear once and for all just how much of federal money spent for Reclamation makes its way back to the Treasury in hard cash.



PLANT CROSS SECTION shows how simplified station operation and minimum investment was achieved

Sporn Station Design Achieves

GREATER FREEDOM to plan new facilities using equipment of the post-war period has made it possible to again advance the front of economical energy generation by steam-electric processes.

This has been at least partially accomplished at Philip Sporn station where efforts have been made to combine, in optimum fashion, the elements of site, heat cycle, fuel and equipment.

Philip Sporn station on the Ohio River is located at the boundary of the two largest groups in the Central System—The Ohio Power Co and Appalachian Electric Power Co. The site consists of about 275 acres with 600 ft of frontage on the Ohio River. Contiguous coal reserves in Ohio and West Virginia amount to about 22,340 acres of an estimated 132,000,000 tons of coal. The river is navigable with 9-ft slack water navigation channel and has a minimum flow of about 2,200 cfs. Thus there is no question about adequacy of the site for the development of a plant of at least three times the size of the present project. Extent of the coal supply and its contiguity to the plant give assurance that developments in underground gasification, if they should materialize, can be exploited in the future for such savings as may be possible. Thus the site seems to meet every requirement for economical generation.

PHILIP SPORN*
President
American Gas & Electric Service Corp
New York

Heat Cycle

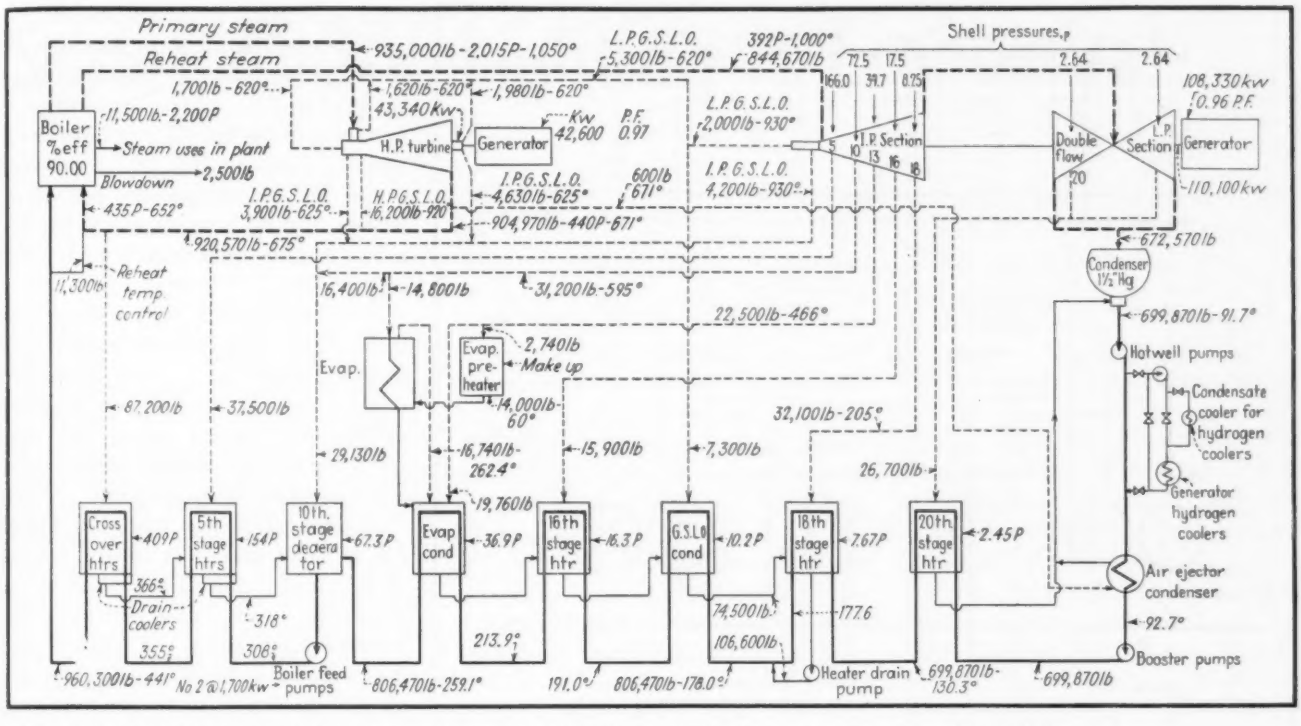
The 2,000-psi, 1,050-F initial temperature, 1,000-F reheat cycle that was adopted is shown. The major objective in developing this cycle was optimum financial return, taking into consideration not merely economy of fuel but also reliability, for fuel economy means little to a plant that is shut down.

Heat rate at a net plant output of 141,000 kw is estimated at 9,270 Btu per net kwhr output with an expected 90 percent boiler efficiency. This is a better heat rate than has been incorporated into any steam-electric station up to the present time.

In studying the economic possibilities of the various cycles, there was no question that a regenerative-reheat cycle offered the best heat performance. This led to comparative cost estimates of reheat vs non-reheat, with the balance in favor of reheat. As finally adopted, reheat gave roughly 5 percent better heat rate, with a higher first cost of about 2 percent. Needless to say, this makes the reheat cycle *for this station* a most attractive investment.

Although the condenser is being designed for minimum condensate refrigeration and 0.03 cc per 1 oxygen content at rated load, a deaerator to operate under positive pressure is being installed to insure thorough deaeration of the feedwater even under extreme load changes. In the past, the source of air in-leakage to condensers and other oxygen contamination of condensate has been difficult to track down completely and the in-

* Based on a paper presented before American Society of Mechanical Engineers, December 1-5, 1947.



HEAT BALANCE DIAGRAM—Net plant heat rate is 9,270 Btu per kwhr for a net plant output of 141,520 kw

Efficient Low-Cost Operation

cremental cost of a deaerator over the equivalent closed heater is felt to be good insurance against boiler corrosion which, in turn, would adversely affect plant reliability.

The means used to cool the main generator is another example of the effort made to incorporate high reliability in the cycle. After leaving the condenser, a portion of the condensate is passed through the generator hydrogen coolers. The purpose is to preclude the frequent cleaning of the hydrogen coolers which would result if river water were used.

A condensate cooler is provided in which river water cools the condensate to the degree required in the summer time. Even after passing through the hydrogen coolers, the water is still cooler than in the main condensate stream. Therefore, the cool condensate is sent to the suction of the hydrogen cooler pump to pass again through the hydrogen cooler to condensate cooler to pump cycle. The cool condensate in this cycle "floats" on the main condensate stream but does not mix with it. The main condensate stream is not cooled off by the cooler condensate in this sub-cycle.

Turbine Features

The new cross-compound turbine is a new combination of high-pressure and low-pressure turbines. The 3,600-rpm high-pressure element has a rating of 35,000 kw and a capability of 42,000 kw. Its throttle conditions are 2,000 psig, 1,050 F. The two emergency stop valves as well as the turbine inner shell will be chrome-nickel-moly, columbium stabilized. The turbine outer shell will be moly-vanadium.

The 1,800-rpm low-pressure element has an intermediate-pressure turbine in tandem with a double-flow low-pressure section. The whole is rated at 95,000 kw with a capability of 108,000 kw. The intermediate-pressure section receives steam from the reheater at 375 psig, 1,000 F, and exhausts at about 8 psia to the double-flow low-pressure section. Its high-temperature parts will be of moly-vanadium.

Among the features that improve the reliability and safety are:

Protection against sudden temperature changes by an initial pressure regulator.

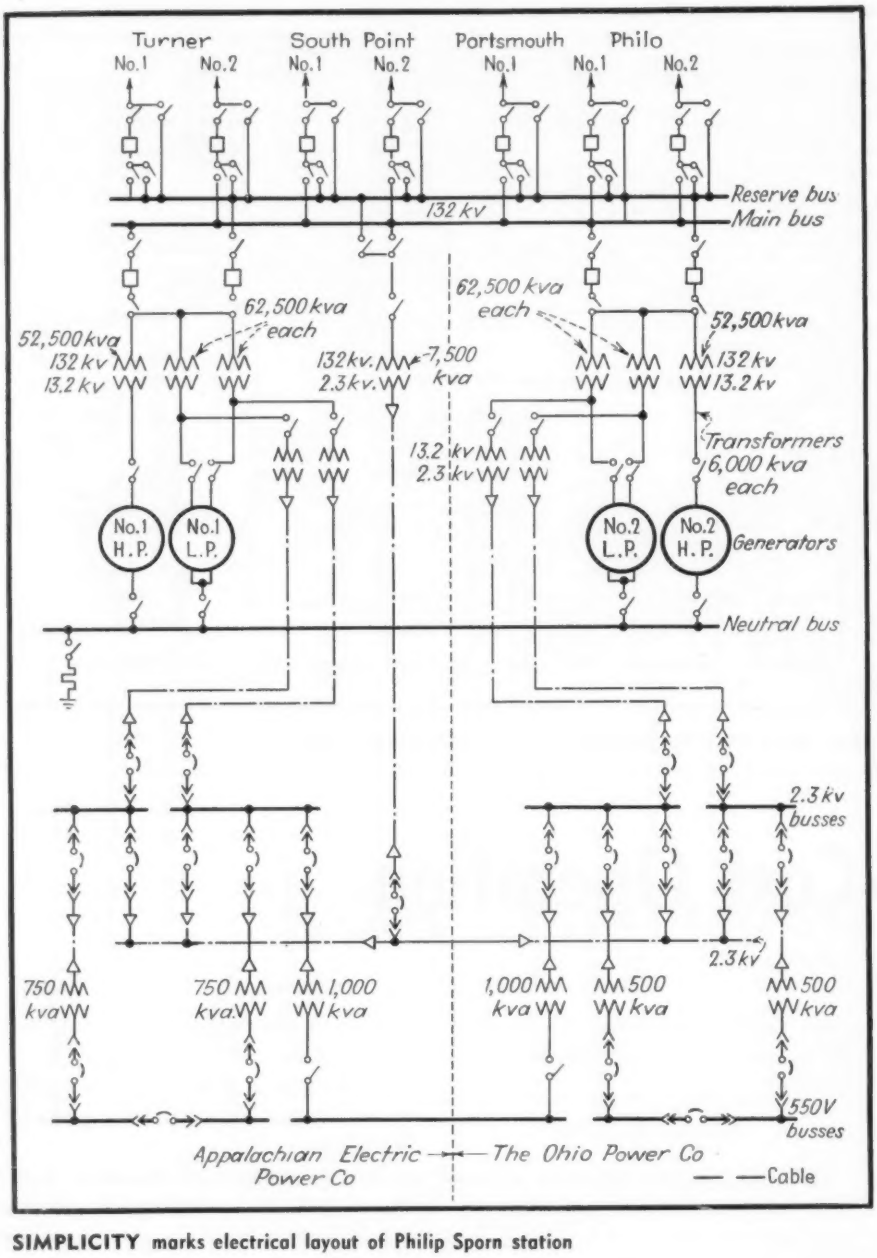
Protection against excessive starting speeds by a two-speed, motor-operated, synchronizing device on the main operating governor.

Automatic steam-seal regulator and unloading valve.

Automatic low-vacuum trip.

Total heat input of 1,300,000,000 Btu per hour to produce 150,000 kw gross generation, makes the boiler one of the largest, if not the largest from the standpoint of net input that has been projected anywhere. It is designed for maximum continuous steam output of 935,000 lb per hr at 2,035 psig, 1,050 F at the superheater outlet. A temperature of 1,060 F will be maintained between 850,000 to 925,000 lb per hr by an attemperator between the primary and secondary portions of the superheater.

After passing through the high-pressure turbine, the steam will be exhausted at around 400 psi, and



SIMPLICITY marks electrical layout of Philip Sporn station

some 850,000 lb per hr will be returned at 650 F to the reheater where it will be raised to 1,000 F. This temperature will be maintained at 1,000 F between flows of 750,000 and 850,000 lb per hr by an attemperator just before the inlet header to the reheater.

Flue gases discharged from the Ljungstrom air heaters go into the stack at about 235 F. The 12-in long cold-end layer of the air heater will be made of Corten steel, which, together with recovery of air heated by boiler room radiation losses, will resist corrosion caused by the low flue gas temperature.

Five coal pulverizers will be furnished for each boiler. There will be ten burners per boiler of the multiple intertube type. These fire vertically downward into the completely water-cooled tangent tube furnace. The furnace is divided laterally by a curtain wall of bare tubes which serve to provide a substantial increment of cooling surface to realize reasonable heat release rates. The curtain wall tubes are staggered in groups in the lower portion of the furnace for equalization of furnace pressures.

Another outstanding feature will be the attempt to run without induced draft fans. To do this the entire casing will be made tight for a furnace pressure of 15 in. of water. However, induced draft fans will be installed in case this forward step in the art of coal burning is not successful.

Since coal from strip mines must often be accepted, a straight down spout from the coal bunker to the pulverizer mill feeder will preclude hang-ups. To facilitate this layout no coal scales will beinstalled for individual boilers, but all incoming coal for the entire station will be weighed while on the belt.

Four mills will ordinarily carry the load of one boiler; the fifth mill will act either as a spare to permit repairs on other mills, or may be called into service when the coal is of such poor quality that boiler capacity may be endangered.

Special effort was made to design for a clean plant. A major source of dust and dirt within a plant is the expansion joints in the hot air ducts between Ljungstrom air heaters and the burners. In the Philip Sporn plant all hot air ducts under pressure will be welded, and bellows-type expansion joints will replace the usual slip-type joints.

Full condensed back-washing will be provided as extended experience with other stations has indicated that revolving screens are insufficient to cope with keeping condensers in operation under such conditions. It is possible to reverse the flow completely through each half of the condenser, thus removing the accumulation of leaves and leaf stems that become woven into a felt-like mat on the condenser tube sheet. Experience at the Windsor, Glen Lyn, Tidd and Philo plants indicates no alternative to full-capacity back-washing.

The electrical arrangement is shown diagrammatically. Its outstanding feature is the extreme simplicity. A 3-phase, 52,500- and two 62,500-kva, 3-phase transformers step up the high-pressure generator, and the two windings of the low-pressure generator to 132,000 v through a single switch to each of the two 132,000-v buses. No low-voltage switches or buses are employed. Auxiliary power is furnished by two 6,000/8,000-kva transformers connected one to each of the low-pressure generator windings and stepping down to 2,300 v. Seven feeders at 132,000 v take the output of the station to the system. Each of these is switched through a single oil switch operable on either the main or the reserve bus.

Series 480-V Lighting is Economical

• **O. O. RANDS**
Electrical Engineer
12th Naval District
San Francisco, Calif.

TO ADAPT a lighter - than - air (blimp) hangar for use in the repair and overhaul of airplanes, it was necessary to provide lighting of approximately 30 ft-c over an area of 80,000 sq ft, and from fixtures with minimum mounting height of 52 ft. The immense hangar, located at Naval Air Station, Moffett Field, Calif., was to be used for servicing planes of the Naval Air Transport Service.

Because the project was limited to a minimum expenditure of funds, and because the Navy is not governed by the National Electrical Code, it was decided to install a 480-v combination mercury and incandescent system. Circuits, as shown in the diagram, consist of four 1,000-w, 120-v incandescent lamps in series on the same 480-v circuit that feeds the mercury lights. This installation does not meet the specific requirements of most safety orders regarding maximum lighting voltage limits. But every other feature has been carefully considered and this departure from accepted conventional practice has been approved by naval authorities. Savings effected by the use of the higher voltage are estimated to have reduced the cost of installation by more than 40 percent.

Use of this system eliminated the need for 300 kva of 480- to 120/208-v dry-type transformers together with feeders and circuit protection. It reduced the number of panelboards from ten 30-circuit lighting type units to four 480-v power-type panels containing a total of 17 three-pole breakers. It materially reduced voltage drop percentages and eliminated approximately 65 percent of the wiring and conduits.

Each combination fixture, as shown, consists of one 400-w mercury and one 1,000-w incandescent lamp mounted in aluminum reflectors. These combination units, having a total initial light output of 37,000 lumens, were mounted on 20 x 20-ft spacing. Steel catenary cables, over 200 ft long, were installed at each bay and fixtures were hung from a rigid conduit system supported from tie wires to the catenary cables.

In this system, the incandescent lamps in one row (four fixtures) were connected in series across 480 v. The individual mercury lamps were each connected to a specially ordered 480-v ballast wired directly across the higher voltage. Each row of four combination units was connected to one phase of the existing three-phase, 480-v, ungrounded delta power system through special lighting control panels. With this connection, three wires extending from one 25-amp, three-pole breaker supply three rows, or twelve combination units comprising 16,800 w of lighting.

Some of the safety items which were considered include:

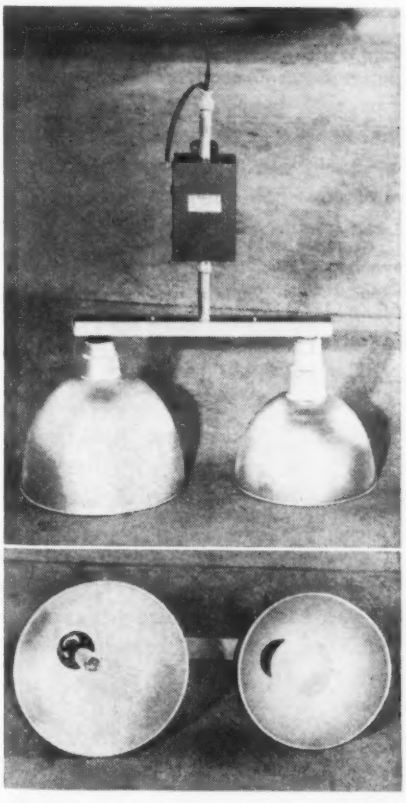
(a) Service for all power equipment in the hangar is supplied from 480-v feeders, so that the maintenance personnel are fully competent to service lighting of that voltage.

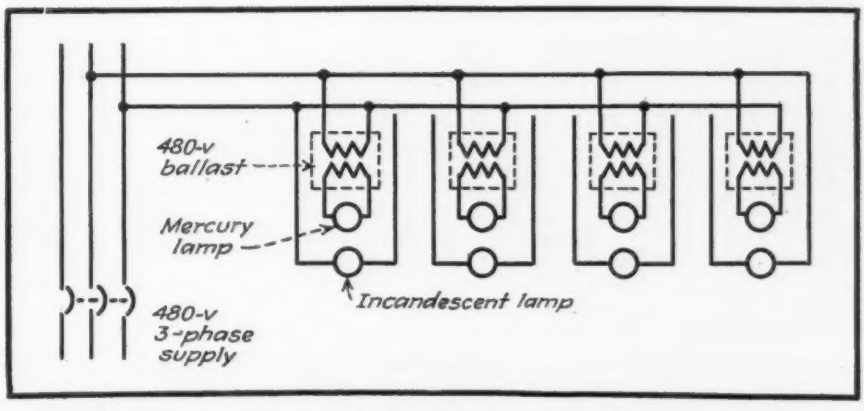
(b) Due to the mounting height of the units, requiring special portable elevating platform equipment, only authorized personnel have access to the units.

(c) The service platform, also used for working on the blimps, provides adequate protection to prevent a workman from falling due to shock.

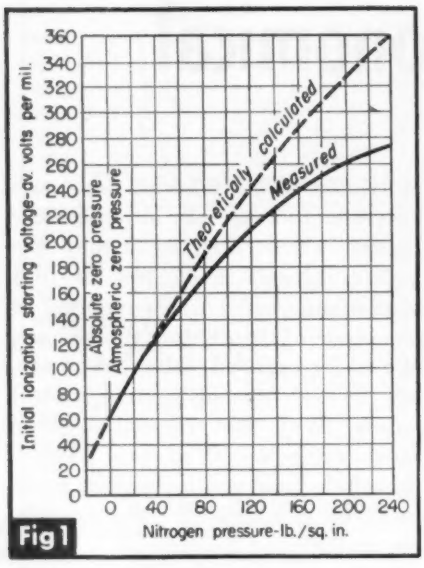
(d) Lighting control panels are in full view from all fixtures and panel doors can be locked to prevent operation while the units are serviced.

(e) All mercury units are connected directly across the circuit so that they indicate whether or not power is connected to the fixture even though the incandescent circuit is open due to the failure of a lamp.

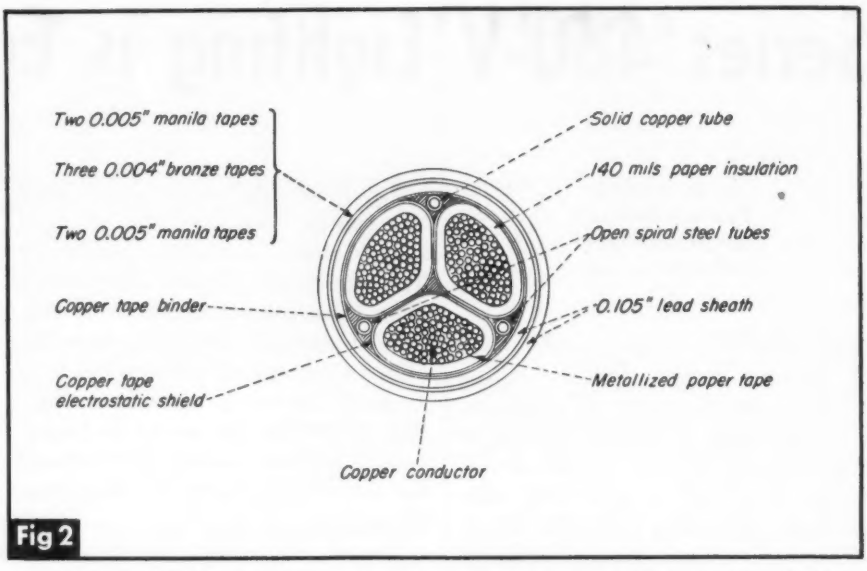




TYPE of combination mercury and incandescent fixture (left) used on 480-v series system. Box on fixture stem contains ballast for mercury lamp. Rare explosions on burnout of 1,000-w multiple-type lamps were eliminated by use of nitrogen filled lamps made especially for series operation . . . Circuit (right) for one row of four combination mercury and incandescent fixtures



VALUES of voltage stress on solid insulation at which ionization starts



CROSS-SECTION details of gas-filled cable. Overall diameter of 2⅞ in. includes double reinforced sheaths

Gas Cable Fortifies Substation

C. F. TITUS and J. D. THOMAS*
Reynolds, Smith and Hills
Architects and Engineers
Jacksonville, Fla.

SOUTH JACKSONVILLE SUBSTATION is served by two No. 4/0 and two 400,000-cir mil varnished cambric, lead-covered cables. These have a rated load capability of approximately 16,000 kw. Peak load on this substation during the winter of 1946-47 exceeded this. A power curtailment resulted each time a cable failure occurred or switching operations required taking one cable out of service.

The desired capacity increase dictated the selection of a 750,000-cir mil, 3-conductor cable, approximately 6,000 ft in duct lines and a submarine section across the St. Johns River 2,500 ft in length. The existing duct line, approximately 1,000 ft in length, is constructed of 3½-in. duct. This imposed a limitation on the physical size of the cable. Small size of existing manholes and the resultant congestion also imposed limitations.

Consideration of rubber-insulated, synthetic-sheathed conductors was quickly discarded. This was done because of excessive costs (approximately twice that of similarly sized conductors in paper-insulated, lead-covered cable), the physical size, and the lack of operating records at 13,800 v in the Southeastern territory except for short runs of cable.

Paper-insulated, lead-covered, oil-filled cable was given careful consideration. This type cable has an excellent operating record at medium and high voltages. But the cost of the terminal equipment, including the apparatus required for degasifying the oil, is excessive and appeared out of line with the relatively small amount of cable involved.

All of the gas-filled cable installed in the 10-40-kv range to date has been designed for operation at a gas pressure of approximately 10 to 15 psi. Construction differs from the solid-type, paper-insulated, lead-covered cable only in a reduction of the insulation thickness and the introduction of gas channels into the interstices between the insulated conductors.

For operation in the 40-69-kv range, the manufacturers recommend the use of gas pressure of approximately 40 psi and this dictates a reinforced sheath.

For crossing the St. Johns River, soundings indicated that a hydrostatic pressure of approximately 37 psi would be encountered. It thus ap-

NORMAL SPLICE has solid tube in two parts

* Adapted from paper at recent annual meeting of Florida Engineering Society.

peared that the low-pressure, gas-filled cable would present a greater hazard to continuous operation at this location than the solid-type cable, inasmuch as a pinhole leak in the sheath of the solid-type cable would admit water which could only permeate the insulation by absorption and capillary attraction. Thus the majority of the cable could probably be salvaged in the event of such leak and subsequent failure, as the distance the moisture could travel would be definitely limited before failure occurred. With the low-pressure, gas-filled cable it appeared that the water would be quickly able to displace the gas within the open steel spiral tubes in the interstices. It would thus travel much faster and for much greater distances than with the solid-type cable, so that when insulation saturation and failure did occur, the major portion of the cable would have been subjected to moisture and would be beyond salvage.

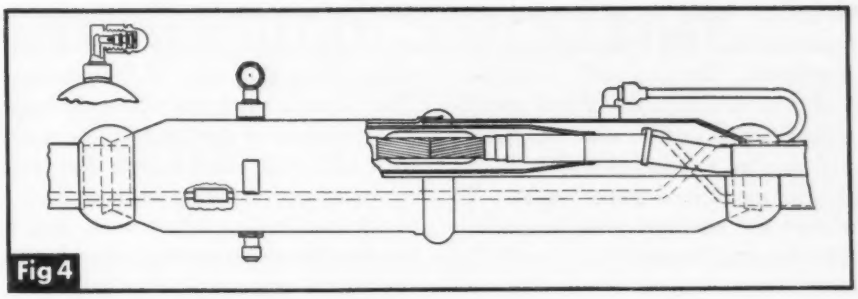


Fig 4

MEDIUM-PRESSURE gas-filled cable joint

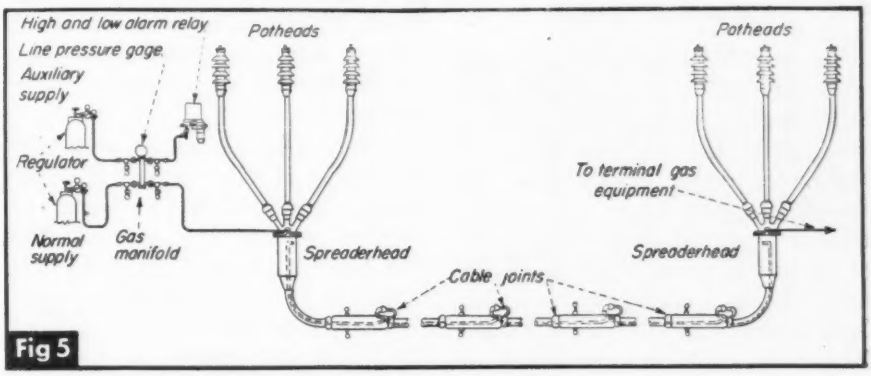


Fig 5

GENERAL ARRANGEMENT of cable and accessories

Final decision was made to specify the cable for operation at a pressure of 40-45 psi. Although the double-reinforced sheath resulted in some additional over-all diameter, this was more than offset by the reduction in the insulation thickness. It was decided to design the new medium-pressure, gas-filled cable for an operating voltage of 100 v per mil of insulation. Fig 1 indicates that under a gas pressure of 40-45 psi, initial

Fig 6

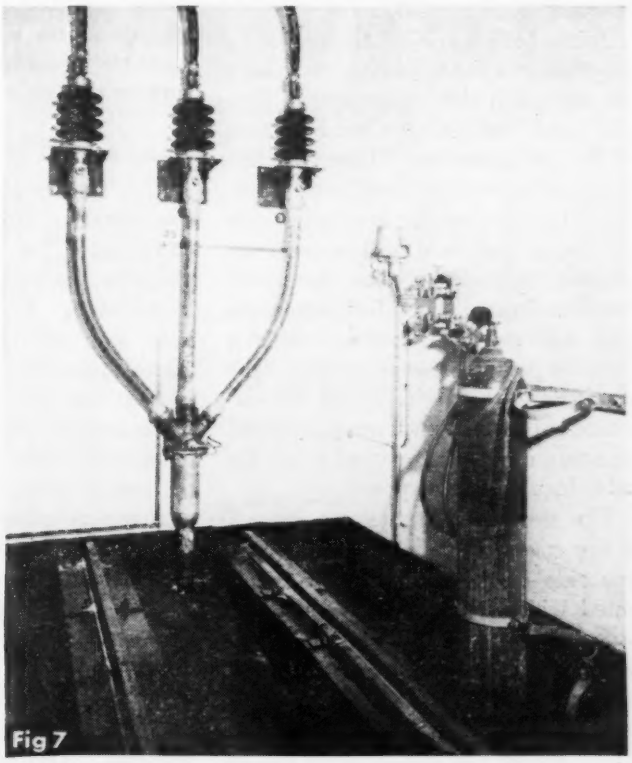


Fig 7

TERMINATIONS at Laura Street substation (above) include 2,000-psi gas cylinder reserve for the 40-psi cable operation

ONE TERMINUS of cable (left) was at South Jacksonville substation and included gas tanks, regulators and alarms

ionization would not start until after approximately 130 v per mil had been impressed. Thus, a safe insulation level was maintained. Final specifications established the insulation thickness as a total of 140 mils, including metallized paper tapes. To achieve the smallest possible outside diameter and to conform to existing installations, compact sector type conductors were used.

Sheath Reinforced

To provide the mechanical strength to withstand the increased gas pressure, the first sheath is reinforced by the application of two layers of 0.0085-in. treated Manila tapes; followed by three layers of 0.004-in. bronze tape; followed by an additional two layers of 0.0085-in. Manila tapes; with a final copper-bearing lead sheath 0.105 in. in thickness. The completed cable structure shown in Fig 2 was only $2\frac{7}{8}$ in. over-all diameter, including the double-reinforced sheath. This meets the limitation imposed by the $3\frac{1}{2}$-in. duct. The gas-filled cable joints are 5 in. in diameter as against $6\frac{1}{2}$ in. for a joint in solid-type cable of the same conductor size.

Joints (Fig 3 and 4) are similar to those utilized for solid-type cable with the exception that spun-copper, two-part joint casings were used because of the gas pressure. There was further used a recently developed crepe-paper tape having characteristics very similar to that used in the cable insulation in preference to varnished-cambric tape. The joints are made with nitrogen gas flowing under a pressure just above atmospheric. This eliminates the possibility of the entrance of even small quantities of moisture during this period when the cable insulation is exposed.

The steel spiral tubes are cut off at the entrance to the joint but only one side of the solid tube is terminated within the joint casing. The other end of the tube is fastened to an extension which projects through one end of the joint and is connected to a fitting on the top of the casing which allows gas to flow in or out of joint. This permits pressure at the individual joint or in the line to be checked at any time when it is felt desirable.

At the termination point of gas-filled cable the simplicity of the equipment offers one of the greatest advantages of this type of installation. The 3-conductor cable passes through a spreader-head similar to those used with solid-type cable except that it is equipped with a fitting for connection to the gas-feeding equipment. From the spreader-head to the potheads the conductors are enclosed in individual lead pipes, which are approximately 2 in. in over-all diameter. The pothead installation is unusual only in that no insulating compound is used to fill the void, as it operates under full gas pressure.

The terminal equipment consists of two tanks of dry nitrogen gas, one used as a normal supply source and one as an auxiliary source. The gas is fed through a regulator to a manifold (Fig 5) consisting of four valves and the necessary connections and Schrader valves to facilitate checking of gas pressure. Two of the connections are made to the gas tanks, the third to the spreader-head, and the fourth to the high-low pressure relay. This relay consists of two single-pole, double-throw switches actuated by two opposing bellows. The relay is adjustable and operates an audible alarm with either an undue decrease or increase in the gas pressure on the cable.

Sheath Supervision

This feature alone justifies serious consideration of gas-filled cables for comparable installations. The gas pressure maintains constant sheath supervision. In the event of a pinhole leak or sheath damage, the alarm promptly indicates the loss of gas, so that gas can be fed into the cable and the pressure maintained at the normal value during the time that the leak is being located. While the nitrogen cylinders remain connected at all times, the valves are closed and, under normal operating conditions, the cable will require additional quantities of gas only at intervals ranging up to six months.

In the installation of gas-filled cable, very little auxiliary equipment is required. Two tanks of dry nitrogen gas and two sets of regulators are required in making a joint. At the beginning of the installation it was anticipated that two joints would be made simultaneously, requiring four tanks and four regulators. Experience indicated that it was rather difficult for one cable splicer to complete a joint in eight hours and that some advantage was obtained by the use of two cable splicers per joint.

Gas Auxiliaries

In this particular installation gas terminal equipment, including gas tanks, regulators, manifold and high-low alarm relays (Fig 6 and 7), are installed at each end. In a shorter section of cable or where a submarine section did not exist, the installation of only one set of terminal equipment would suffice.

Upon completion of all joints and the installation of the terminal equipment, the pressure on the cable is raised to 50 lb and leak tests are again made on all terminal fittings, wipes and all joints in the line. After these checks have been made and any leaks stopped, the pressure is lowered to 45 lb, which is the operating pressure for this particular cable.

Location of leaks may be determined with little difficulty. Regulators at each end of the line are set at exactly the same pressure. The valve on the manifold is opened to allow the regulators to float on the line. It is advisable to use only one or two gages which have been calibrated and move them, making pressure checks at each joint. These gages are equipped with an adapter similar to that used on an ordinary tire gage, which depresses the Schrader valve when placed on the fitting. These pressure readings are then plotted against the distance. The intersection of the pressure curves denotes point of the approximate location of the leak.

In the installation of this cable only one gas leak occured which was difficult to locate. Under normal operating conditions, when a leak occurs, gas is fed into both ends of the cable and the leak located. This particular leak, however, occurred in a gas fitting at one terminal. Since the leak occurred immediately adjacent to the regulator there was no drop in pressure at this point. To locate this leak the gas regulators were completely shut off on both ends of the line. The pressure drop then indicated a definite flow of gas in this direction and was traced to the faulty fitting.

Six Variables in Ground Resistance Studied for 18 Years

C. B. DOWNER
Staff Engineer
West Penn. Power Co
Pittsburgh, Pa.

Farm of 61 ground rods and pipes afford conclusions on salt-life, rainfall correlation, depth-resistance ratio, paralleling and benefit from increased rod or pipe diameter

DURING 1929 a group of 33 untreated and 28 treated ground rods and pipes were installed in a sloping field (Fig. 1) less than a mile southwest of Lock No. 4 of the Monongahela River. (Elevation at test plot 840 ft, at river 740 ft). Grounds were located (Fig 2) with untreated rods and pipes on the upper side away from the road. The bottom row of salt-treated grounds was parallel with the road and 18 ft from the poles at the right of the picture.

Rods ($\frac{5}{8}$ in. and $\frac{3}{4}$ in.) and galvanized pipes (1 in.—$1\frac{1}{4}$ in. + $1\frac{1}{2}$ in.) were driven to 6-ft, 7-ft and 8-ft depths. Grounds, marked for treatment, were driven in the center of 8-in. holes $3\frac{1}{2}$ ft deep, prepared with an earth auger. After 75 lb of track salt had been placed around each of these grounds, holes were back-filled on top of the salt. Spacing between grounds was 6 ft in the untreated section and 12 ft in the treated area.

It was the purpose of these tests to obtain information regarding the following features of driven grounds which have been in general use on distribution lines.

1. Effect of salt treatment
2. Estimated life of salt treatment
3. Effect of rainfall on resistance
4. Effect of depth of driving on resistance
5. Parallel vs single grounds
6. Effect of diameter of rods or pipes on resistance

Fig 1

THE GROUND TEST PLOT was located on sloping terrain near Charleroi, Pa.

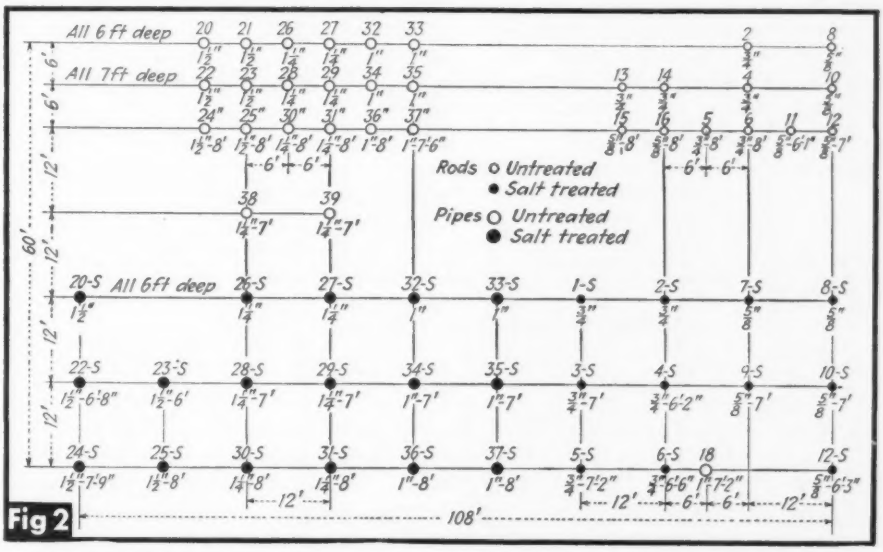


Fig 2

PLAN OF 60 x 108 FT. PLOT provided for disposition of 61 treated and untreated grounds. Untreated rods and pipes are on upper side

Effect of Salt Treatment

Within eight months the resistance of salt-treated grounds had dropped to 40 percent of untreated grounds and remained at this level for about six years. An examination of several treated rods showed appreciable corrosion at the area in direct contact with the salt. Grounding standards should require that salt be buried near the rod but not in direct contact with it.

A measure of the life of the treatment (Fig 3) would indicate that salt remaining in the ground after 18 years was producing about the same effect as that dissolved during the

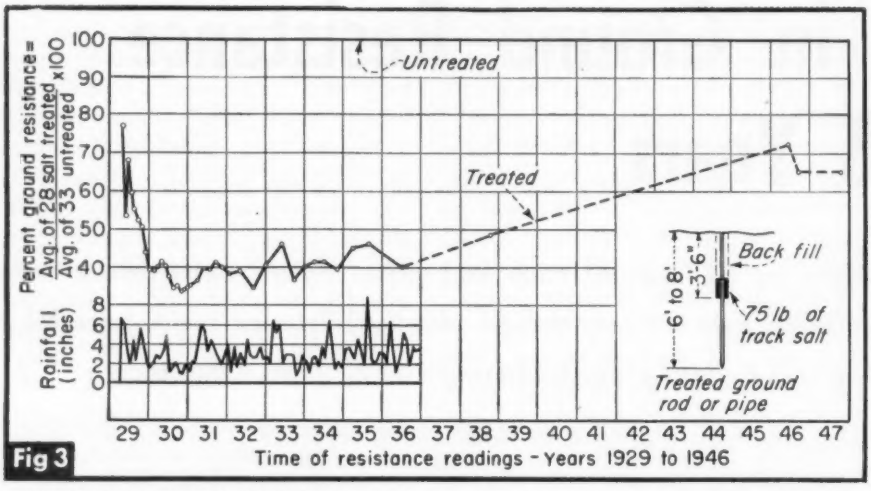

Percent ground resistance = Avg. of 28 salt treated / Avg. of 33 untreated x100
Untreated
Treated
Rainfall (inches)
Back fill
3'-6"
6' to 8'
75 lb of track salt
Treated ground rod or pipe
Time of resistance readings - Years 1929 to 1946

Fig 3

LIFE OF SALT TREATMENT of ground rods and pipes. Based on average values for 28 treated and 33 untreated grounds, expressed as percentage of resistance untreated. A measure of the life of the treatment indicates that salt remaining in the ground after 18 years produces the same effect as that dissolved during the first two months of the test

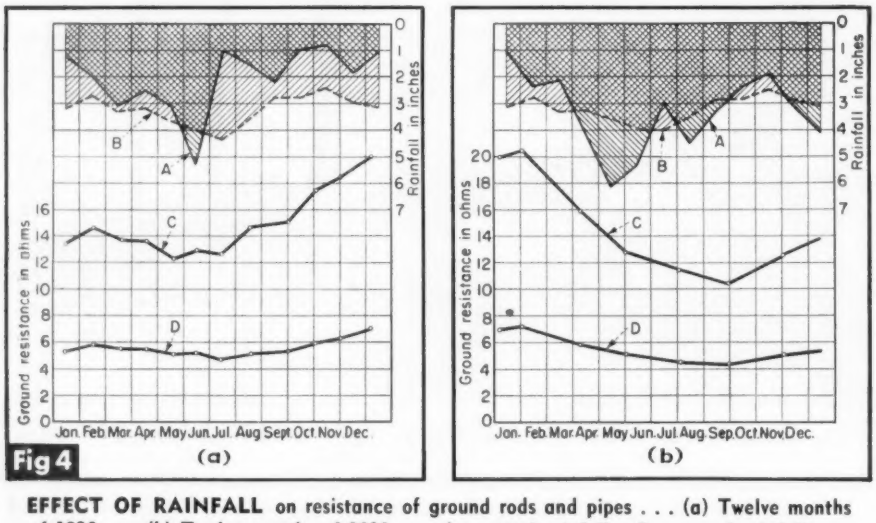


Fig 4

EFFECT OF RAINFALL on resistance of ground rods and pipes . . . (a) Twelve months of 1930 . . . (b) Twelve months of 1931 . . . A=actual rainfall; B=normal rainfall . . . C=Average resistance of 33 untreated grounds . . . D=Average resistance of 28 salt-treated grounds

TABLE I—Effect of Paralleling Two Grounds

Ground Numbers See Fig. 2	Average of Ground Resistance Readings (A)	(B)	A − B Parallel (C)	Theorectical Res. Values of A + B connected in multiple (D)	(C)/(D) × 100 % (E)
UNTREATED GROUNDS SPACED 6 FT APART					
20–21	16.32	16.40	9.20	8.19	112.3
26–27	15.90	15.14	8.73	7.76	112.5
32–33	14.25	17.76	8.76	7.90	110.9
22–23	16.82	13.30	8.44	7.44	113.4
28–29	10.79	13.21	6.86	5.94	115.5
34–35	16.22	12.80	8.09	7.16	113.0
13–14	13.81	13.82	7.93	6.90	114.9
24–25	11.57	12.04	6.82	5.90	115.6
30–31	10.24	10.29	6.07	5.14	118.1
15–16	12.93	11.38	7.07	6.05	116.9
5– 6	12.10	10.43	6.64	5.60	118.6
SALT TREATED GROUNDS SPACED 12 FT APART					
26s–27s	6.12	5.55	3.66	2.92	125.3
32s–33s	5.73	8.80	4.20	3.47	121.0
1s– 2s	6.88	5.50	3.81	3.06	124.5
7s– 8s	7.42	5.61	4.08	3.20	127.5
28s–29s	7.72	5.05	3.78	3.06	123.5
34s–35s	5.88	5.19	3.57	2.76	129.3
9s–10s	5.40	7.15	4.12	3.08	133.8
30s–31s	6.07	5.25	3.96	2.82	140.4
36s–37s	5.78	5.90	3.79	2.92	129.8

first two months of the test. Variations in percentage resistance were caused by rainfall which affected the resistance of untreated more than that of treated grounds.

The life of the salt treatment in this case may have been increased by the 3½-ft depth of the treated area which avoided loss of salt due to surface drainage. The character of soil was loam on clay with a scattering of rock at about 6 ft.

Effect of Rainfall on Resistance

Effect of rainfall on ground resistance is shown in Fig 4A & B, which compare treated and untreated grounds during 1930 and 1931 with a monthly record of rainfall at Lock No. 4 of the Monongahela River. Ground resistance, both untreated and salt treated, increased during the 1930 drought; the former from 11.4 ohms to 20.5 ohms (+ 80 percent) and the latter from 4.5 ohms to 7.25 ohms (+ 61 percent).

Effect of Depth of Driving

Due to the difficulty of driving rods or pipes in most sections of southwestern Pennsylvania, this investigation was made for relatively shallow depths. Ground resistance can be reduced by driving rods deeper so that they can take advantage of added moisture. This is indicated by the average of 40 sets of readings for each group of grounds in the record of tests from 7-1-29 to 9-9-46 in Table II.

Parallel vs Single Grounds

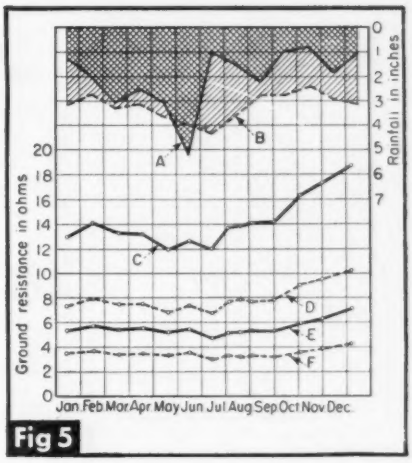
Grounds were arranged so that parallel readings could be obtained at 6-ft spacing for untreated and 12-ft spacing for salt treated. These parallel resistances taken as a percentage of the resistance of single grounds averaged 57 percent for untreated and 63 percent for salt treated. A comparison of single and parallel readings on 30 grounds is shown in Fig 5. The parallel readings were slightly higher than the theoretical resistance of two single resistances connected in multiple. The values in Table I are average, based on 44 sets of readings taken on the group of 30 grounds.

Resistance readings obtained during these tests showed that rod or pipe diameters ⅝ in. to 1½ in. had no appreciable effect on the ground re-

TABLE II—Deeper Driving Decreases Resistance Somewhat

Depth Driven (feet)	UNTREATED No. of Grounds	UNTREATED Average Resistance (ohms)	TREATED No. of Grounds	TREATED Average Resistance (ohms)
6	9	17.38	11	6.51
7	13	14.41	8	5.93
8	9	11.43	5	5.83

sistance readings. This would indicate that the resistivity of the soil was considerably higher than that part of resistance contributed in the form of contact resistance between the electrode and the ground.



AVERAGE RESISTANCE of single and parallel ground rods and pipes

A=actual rainfall; B=normal rainfall . . . Average resistances: C=22 single untreated . . . D=11 parallel untreated (6 ft. spacing) . . . E=18 single treated . . . F=9 parallel treated (12-ft spacing

Fig 5

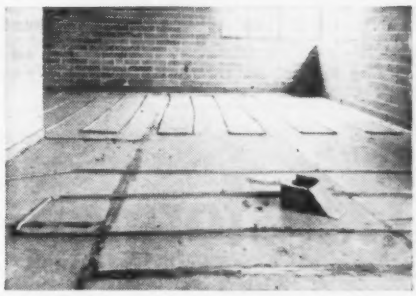
Low-Voltage, High-Current Radiant House Heating

ELECTRIC HOUSE HEATING using radiant heat produced by a high current at low voltage in a ½-in. steel cable is one of the latest West Coast developments. The system was developed and patented by Ruben S. Tice of Tice Electric Co, Monterey, Calif., and is known as "Electradiant." Unlike other radiant floor heating systems that use small-resistance wire operating at high temperature off 120-v circuits, the Tice system uses a ½-in. special Bethlehem plough steel rope cable through which a current of 125 amp is circulated. The large cable insures almost complete freedom from electrical and mechanical failures, is easily installed, and offers a large, low-temperature (110 F) radiating surface.

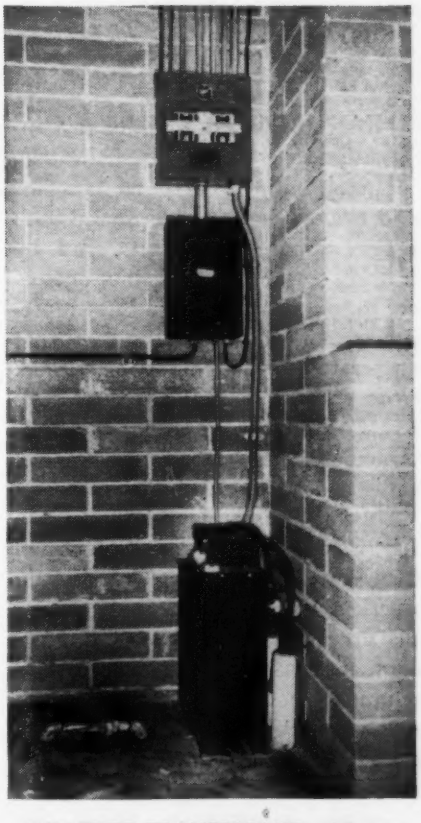
Dry-type transformers step down from a primary voltage of 240-v to whatever secondary voltage is required for the length of cable in each circuit. Secondary voltages range from 20 to 70 v. In the installation illustrated, a six-room, 1,400-sq ft, concrete block house in Oakland, Calif., there are two circuits and two transformers. One circuit 480 ft in length covers the three bedrooms, bathroom and hallway. The other, 580 ft long, covers the living room, dining room and kitchen. Wattage density per sq ft can be controlled simply by varying the spacing of the heating cable. Densities range from 10 to 15 w per sq ft; spacing is normally 1 ft. Resistance of the cable is such that 9 ft per volt gives a current of 125 amp. Maximum temperature of the cable is limited to 120 F by a special thermostat in direct contact with the cable at one of its terminals. Room temperature is controlled by a thermostat for each of the two heating circuits. Floor temperature runs from 70 to 74 F to give the thermometer reading of 67 F found sufficient for radiant heating.

Most of the installations so far have been made in concrete floors. However, several wood floor jobs have been made with good results. In concrete floors, a 4-in. base slab is first poured.

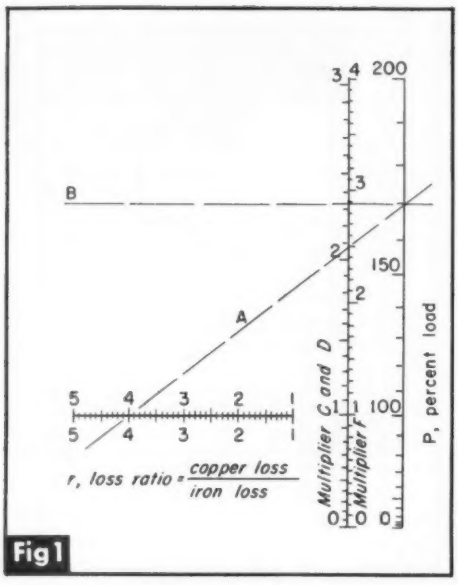
THERMOSTAT placed in porcelain bushing rests in contact with steel cable to insure that maximum temperature of conductor will not exceed 120 deg F.

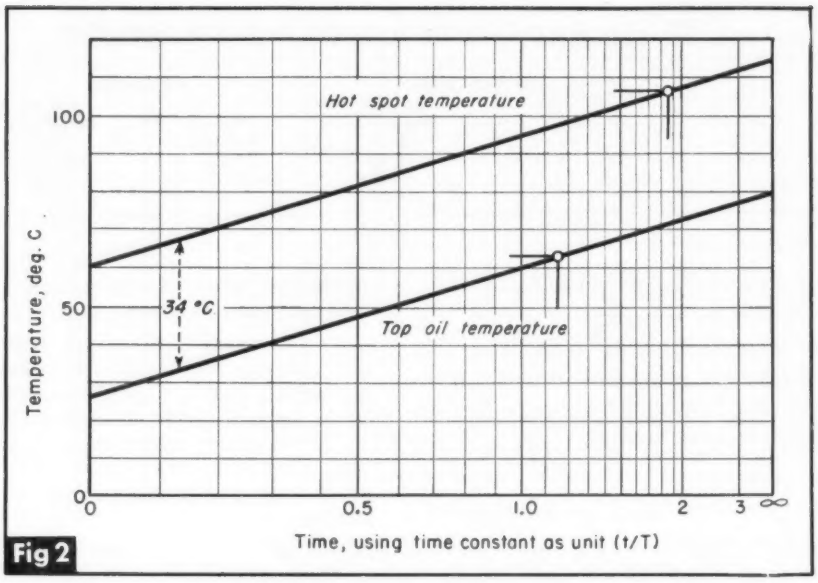


ELECTRIC heating element is stapled to Celotex sub-flooring



DRY-TYPE TRANSFORMER with contactor cabinet directly above





ALIGNMENT CHART (Fig 1) for computing oil-rise multipliers "C" and "F" and gradient multiplier "D." To find "C" or "F" connect (as in line A) values of load "P" and loss ratio "r" and read "C" or "F" at the intersection with the corresponding scale. To find multiplier "D" construct a line through the value of load "P" parallel to the "r" scale (as in line B) and read "D" at the intersection with the "D" scale . . . Variation of top-oil and hot-spot temperature (Fig 2) for conditions of Example No 1 where a load of 150 percent is applied to a transformer following a long no-load period with full excitation

Transformer Temperatures—Graphically

PAUL NARBUTOVSKIH
Transformer Engineer
Westinghouse Electric Corp
Sharon, Pa.

Formulas, charts and graphical procedure are detailed step-by-step for determining winding temperatures of oil-immersed transformers subjected to complex load cycles

TRANSFORMER winding temperatures for all points on the temperature-time curve of complex load cycles can easily be found with a few simple calculations, and by drawing several straight lines on special graph paper. These lines represent transformer top-oil and hot-spot temperatures plotted against time. From such graphs, the highest temperatures during the cycle or the intermediate temperatures at other instants can be read directly.

The method, explained in this article, is based on a generally accepted theoretical foundation. There is no practical exact method. However, this graphical method has an accuracy that is fully as good as basic data obtained from either commercial tests or calculations. The probable error doesn't exceed a few degrees for overloads below 200 percent.

Certain information about the transformer is required before preliminary computations can be made. It consists of the following four key quantities.

1. Θ_{or}, top-oil temperature rise at 100 percent continuous load.

2. Θ_{gr}, hot spot temperature gradient from the hottest copper to top-oil at 100 percent load.

3. r, the copper loss to iron loss ratio at 100 percent load.

4. T, time constant of the transformer.

Best source of this information is the transformer manufacturer. Second best source is the test and design data on the transformer. This, if available, should include a temperature test at 100 percent load applied continuously, copper and iron losses and the weights of the core and coils, the oil, and the tank. If not available, top-oil temperature rise at 100 percent load (Θ_{or}) can be obtained by direct measurement. Hot-spot winding gradient is obtainable by adding an arbitrary 10 deg to the average copper rise obtained by test, and subtracting from this the top-oil rise. The loss ratio is computed from the known iron and copper losses.

Time Constant

The time constant, T, determines the rapidity with which temperature changes with changing load. It depends on the relative weight of the transformer, the total power loss at rated load, and the corresponding oil temperature rise. It can be computed by the formula*:

$$T = \frac{\theta_{or}}{W_o}\,[0.06 \times (\text{weight of core and coils in lb}) + 0.04 \times (\text{weight of tank in lb}) + 1.33 \times (\text{volume of oil in gal})] \quad (1)$$

where:
T = time constant, hours
θ_{or} = top-oil temperature rise at 100

percent load, deg C
W_o = sum of iron and copper loss at rated load in watts

Depending upon the type, voltage class, etc, of the transformer, the time constant for different units varies over a considerable range, but generally is between 1½ and 10 hr.

If the characteristics of the individual transformer are not available, conservative average values for the type must be used. Before making detailed computations in this case it is best to consult data in the "Guides for Operation of Transformers," Trans. AIEE, 1945. These offer permissible continuous and emergency overloads for three typical transformers under limited conditions of operation. Should these not suffice, computations of temperatures for a specific transformer and under specific operating conditions can be done as shown in the accompanying examples.

Typical Application

Example No. 1. A load of 150 percent is applied to a self-cooled, oil-immersed transformer, following a prolonged period at no-load with full excitation. Transformer characteristics are:

θ_{or} = 42 C
θ_{oq} = 18 C
r = 2.22
T = 3½ hr
θ_a = Ambient temperature = 10 C

The resultant hot spot temperature vs time graph is given on Fig 2 and is obtained as follows:

Step No. 1—Compute the initial top oil temperature rise (Θ_{ir}), ie, that which existed at the beginning of the load period, using multiplier, C, obtained from chart Fig 1. From the chart, corresponding to the loss ratio of r = 2.22 and zero load, C = 0.39. Initial oil rise will be a product of the rise at rated load, and multiplier, C, ie:

$$\theta_{ir} = \theta_{or} \times C = (42) \times (.39) = 16C$$

Step No. 2—Compute the initial top-oil temperature (Θ_i) by adding the ambient to the oil rise computed in step No. 1:

$$\theta_i = 16 + 10 = 26C$$

Step No. 3—Compute the ultimate top-oil temperature rise, (Θ_{ur}), ie, that which would occur if the 150 percent load were sustained indefinitely. The procedure is the same as in step No. 1 except for the difference in the value of multiplier C. From Fig 1, corresponding to r = 2.22 and the load P = 150, C = 1.64. Hence,

$$\theta_{ur} = \theta_{or} \times C = (42) \times (1.64) = 69C$$

Step No. 4—Compute the ultimate temperature by adding the ambient to the rise:

$$\theta_u = \theta_{ur} + \theta_a = 69 + 10 = 79\ C$$

Step No. 5—On a sheet of the special coordinate paper, Fig 2†, plot the initial oil temperature (26C) at the beginning of time, and the final oil temperature (79C) at the end of time. Connect the two points by a straight line and obtain the plot of the variable oil temperature vs time.

Note that the time scale on this graph is given not in terms of time in hours, but rather as a ratio of time to the time constant, ie, using the time constant as the unit of time. With this in mind the graph can be read directly. Thus, to find the temperature of the top oil at the end of four hours we note that four hours is 4/3.5 = 1.14 on the time scale. Corresponding to this the top oil temperature is 62C. In a similar manner, top-oil temperature of 70C will be reached at t/T = 1.77, or at t = (1.77) × (3.5) = 6.2 hours.

Step No. 6—Compute the hot-spot winding gradient for 150 percent load, using multiplier D, obtained from Fig 1. Corresponding to P = 150 percent from the chart, D = 1.91. The winding gradient for 150-percent load will be a product of this multiplier and the gradient at 100 percent load given in the original data as 18 deg, ie:

$$\theta_g = (1.91) \times (18) = 34C$$

Step No. 7—Plot the hot-spot temperature on Fig 2 by drawing a second curve parallel to the top oil temperature curve and 34 degrees above it at all points. It will be noted that although the winding gradient of 34C over the top oil will not be established instantly after the 150 percent load is applied, the transition period will be quite short, not over 10-15 minutes duration. Neglecting this, as well as the effect of changing oil viscosity and copper resistance, both of which are small, the winding hot-spot temperature will be represented on Fig 2 by the upper curve. From this plot the hot spot tempera-

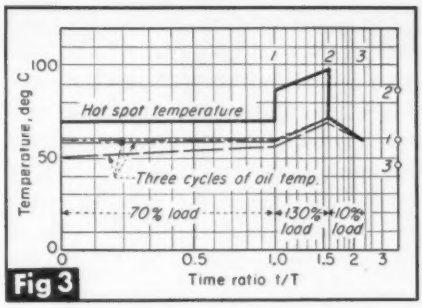


Fig 3

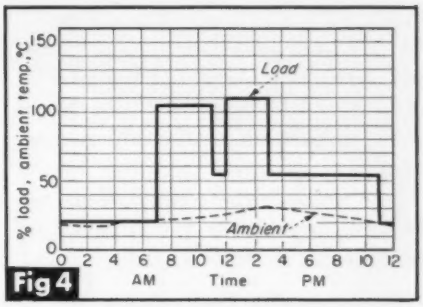


Fig 4

TOP-OIL and hot-spot temperature variation (Fig 3) for a self-cooled, oil-immersed transformer operating under a repeated load cycle as Example No. 2 . . . 24-hour load cycle and ambient temperature variation (Fig 4) illustrating load conditions for Example No. 3

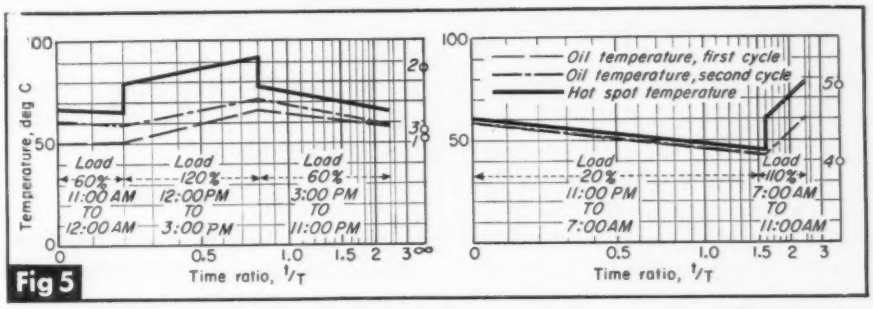


Fig 5

VARIATIONS of top-oil and hot-spot temperature for a transformer operating on a repeated load cycle as in Example No. 3. Due to the long duration of the load cycle, the total cycle is separated into two parts

* "Guides for Operation", Trans. AIEE, 1945.

† Although this coordinate paper has been developed in its present form by the writer, it is well to mention that it was previously suggested in an article by L. C. Nichols: "Effect of Overloads on Transformer Life," AIEE Trans., 1934, p. 1616.

ture vs time can be read directly. Thus, a hot spot temperature of 105C will be attained at $t/T = 1.81$, or at time $= (1.81) \times (3.5) = 6.34$ hours after application of the 150 percent load.

The preliminary computations can be best carried out and summed up in the form of Table I.

Complex Cyclic Loads

Example No. 2—Essentially the same steps are involved in handling more complex cases of cyclic loads. Fig 3 illustrates a case of a self-cooled oil-immersed industrial transformer operated on an eight-hour load cycle, repeated indefinitely, as follows:

First period—70 percent load for $3\frac{1}{2}$ hours

Second period—130 percent load for 2 hours

Third period—no load, with excitation, for $2\frac{1}{2}$ hours

Ambient = 30C

The same transformer is used for this example as in the previous case. The preliminary computations are arranged in Table II:

Line 4 in Table II represents the turning points on the time scale of the graph paper at which the load changes. Vertical lines should be drawn on the coordinate paper corresponding to these values of t/T to designate the three load periods. These lines are marked consecutively as No. 1, 2, and 3 on Fig 3.

The values of the ultimate oil temperature, given on line 7, are plotted next as points, for $t/T =$ infinity, and marked as No. 1, 2, and 3.

Top-Oil Temperature

The next step is to draw the curves of top-oil temperature vs time. Since the oil temperature at the beginning of the repeated load cycle is unknown, any likely value, such as 50C can be used as a starting point. From this point the first straight line is drawn toward the ultimate temperature just determined for No. 1 load period ($\Theta_u = 60$C), but stopping at No. 1 turning point. At this point the direction of the line changes, and the second section of the top-oil temperature curve is drawn aiming at $\Theta_u = 87$C, and stopping at the second turning point. In like manner, the third section is drawn aiming at $\Theta_u = 46$C.

As would be expected, the terminal temperature at the end of the first load cycle is not the same as the starting temperature, since the latter was taken arbitrarily. If the temperature is required on repeated load cycle it is easy to repeat the process, using the terminal values of each cycle as new starting point. On Fig 3, the process was repeated twice, with the result that the third cycle gave the result, probably as accurate as one would wish.

Finally, the hot-spot gradients are added over and above the top oil temperature on Fig 3, giving a solid line of the hot-spot temperature curve versus time on repeated load cycle. As before, the short-lived copper transient is neglected.

Long Load Cycles

Example No. 3—Following the above procedure if the load cycle is as long as 24 hr, the end of the load cycle, with the usual values of the transformer time constant, will be too close to the right hand edge of the coordinate paper. In this region, for values of t/T greater than 3, the scale divisions are crowded, and the accuracy of the plot will be poor. To avoid this difficulty, divide the total load cycle into two or more periods so that the duration of any of these periods does not exceed three times the duration of the time constant. Use a separate sheet of coordinate paper for each of these periods, and start counting the time in each period with zero value.

To illustrate, an example of self-cooled oil-immersed industrial substation transformer has been taken, loaded according to the following load cycle:

	Percent Load
7:00 am to 11:00 am.....	110
11:00 am to 12:00 am.....	60
12:00 am to 3:00 pm.....	120
3:00 pm to 11:00 pm.....	60
11:00 pm to 7:00 am.....	20

Following are the transformer characteristics:

$\theta_{or} = 45$ C
$\theta_{oo} = 15$ C
$r = 2\frac{1}{2}$
$T = 5.0$ hr

To visualize better the character of the load cycle, it is given in the form of a graph on Fig 4. The same graph shows the variation in ambient during the 24-hr period, which is taken in account in the computation of the cyclic temperatures. Inspection of the load cycle suggests one possible convenient subdivision of it into two periods, namely from 11:00 am to 11:00 pm, and from 11:00 pm to 11:00 am.

Preliminary computations are carried out accordingly in Table III. The only difference between this and the preceding example is that the total cycle is divided into two distinct periods, each beginning with zero value of time. Also, a variable ambient temperature is used in computing the ultimate oil temperature corresponding to each load value.

The plot of the cyclic temperatures is given on Fig 5. Two sheets of the coordinate paper are used to represent the complete cycle. Starting the first load period with an arbitrary 50C oil temperature, it was necessary to repeat the load cycle twice in order to get the final temperature curve for repeated cycle. It is observed that the maximum hot-spot temperature reached during the repeated cycle is 92C and occurred at the end of the 130-percent load period.

Forced-Cooled Transformers

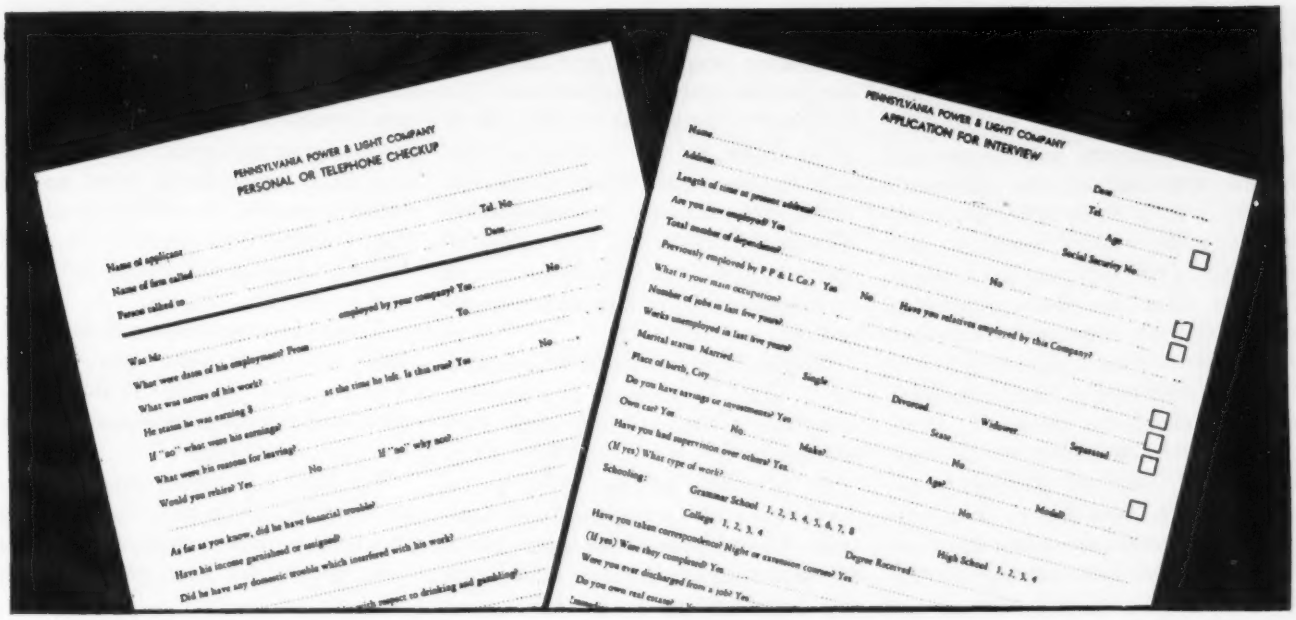
The procedure of determining transformer temperatures on load cycles, that may be used for forced-cooled transformers, is the same as that outlined above for the self-cooled transformers in every detail except one: a different scale must be used on chart, Fig 1, for determining the value of the top oil-rise multiplier, as follows:

For transformers equipped with external fans as well as the forced oil circulation, use multiplier F for determining the ultimate oil rise, instead of multiplier C. Multiplier F is obtained from Fig 1, using the right-hand multiplier scale.

For transformers equipped with external fans, but with natural-oil circulation, read both sides of the multiplier scale and take the average value.

Multiplier D for the hot-spot gradient is obtained in all cases using the left-hand side of the multiplier scale.

The characteristics of the transformer, ie, Θ_{or}, Θ_{oo}, r, and T, as well as the 100 percent load for the forced cooled transformers should all correspond to the forced cooled rated load.


PENNSYLVANIA POWER & LIGHT COMPANY
PERSONAL OR TELEPHONE CHECKUP
PENNSYLVANIA POWER & LIGHT COMPANY
APPLICATION FOR INTERVIEW

Scientific Methods Assure Better Selection of Sales Personnel

P. W. SIEKMAN,*
Pennsylvania Power & Light Co
Allentown, Pa.

Screening method ending in patterned interview gives power company high grade sales organization of 200 men in 2 years

DURING THE WAR, our sales organization was drastically reduced. We knew, long before the end of the war, that we would have to rebuild it. We wanted to do this with the best possible material. We wanted men who could sell our services, who could create and hold customer good will, and who would be easy to train and supervise. In the past, salesmen had been hired on personal judgment alone. We had no plan or predetermined method of interviewing nor did we have a very clear idea of just what we were looking for in a salesman. This method had been used because only a relatively few sales people were employed at a time, mostly for replacements. Now it became necessary to hire several hundred people, many of whom had never done any selling or who had been out of sales work for several years.

Our problem was further complicated because the new sales personnel would be spread over 9,800 square miles and would be selected by local supervisors. It was necessary to set up a selection program that would be simple and still give us the type of personnel desired.

We reviewed several methods of selection, but found none that exactly fitted our problem. We did find that the Servel Salesman Selection Program, prepared for Servel, Incorporated, by Dr Robert N. McMurray, came closest to fitting our needs. With this as a basis and with the Servel's permission, we developed what we call the Pennsylvania Power & Light Co Scientific Selection of Sales Personnel.

Nine Basic Traits

Tests show that successful sales people must have nine basic traits. These are: Motivation, maturity, leadership, stability, ambition, industry, perseverance, loyalty, and ability to get along with others. People who possess these traits, when properly trained and supervised, have the best chance to succeed in utility sales work. We believe we have a method for determining to what degree an applicant possesses or lacks these nine basic traits before he is hired.

There are four major procedures in the program. They form a series of screens.

The first is a brief preliminary interview to eliminate those who are obviously unfit.

Second is a weighted application form designed to exclude those whose qualifications permit little chance for success. This form considers seven items: (a) age, (b) total number of dependents, (c) number of jobs in the last five years, (d) time unemployed in the last five years, (e) employment status at time of application, (f) marital status, and (g) possession of savings or investments. Each of these items is weighted in numerical value. An applicant who makes a minimum score is rejected at once. The weighted application operates like an insurance actuarial table. If the percentage is against

* Assistant General Commercial Manager.

the man, he is rejected and notified accordingly.

Third is a telephone or personal check. This is used to obtain from previous employers a complete and honest appraisal of the applicant's history. It is imperative that contact be made with at least one company where the applicant has worked. Two or three are recommended to guard against infrequent black-listing. These contacts are made before the final interview. The interviewer thus can check the applicant's statements, catch omissions or falsifications, and learn of possible weaknesses. We have found that telephone or personal check-ups are much more reliable than written reports. Former employers will often reveal oral information that they would otherwise hesitate to put in writing. The telephone check-up is not in itself a screening device. But it may make available to the interviewer information about an applicant that can be obtained in no other way. This personal or telephone check-up is always made by the individual who will do the interviewing. Thus discrepancies, if any, are uncovered. This also permits the interviewer to have a first-hand knowledge of all pertinent facts that may affect the situation.

Fourth, the patterned interview is held. This is designed to provide a complete picture of the applicant's suitability for the job. This interview is strictly private; only the interviewer and the applicant are present. The purpose of this interview is to extract as much information from the applicant as is possible. The questions are printed and the answers are recorded on a form. The content and order of the questions are designed to get the applicant to talk about himself. It is essential that the interviewer be friendly and the interview be kept informal. It should not become a cross-examination. The form covers the applicant's work record since high school; what he did with his spare time; amount of schooling; family background; financial status; domestic and social situation, and his health.

From the answers to these questions, the interviewer can form a well rounded opinion of the applicant, and can judge his suitability for the position available.

We have been using this selection program for about two years. During this time we have employed over 200 sales people; all have gone through the patterned interview. We are convinced that we have a much better sales organization than we would have had if our former methods had been employed.

Patterned Interview for Sales Position Applicants

Because of space limitation, it is impossible to reproduce the interview form here. Instead, the questions to the applicant and the notes for guidance of the interviewer in forming his conclusions are presented exactly as printed on the form. The questions are numbered and following them are the notes in italics. On the form, the notes are printed in red immediately below the dotted lines provided for entering replies to questions.

AT THE TOP of the form are the numbers, 1-2-3-4, to be checked by the interviewer to show his final rating of the applicant. Following the interviewer's name and the date, is space for the interviewer's comments. He is instructed, "In making final rating, be sure to consider applicant's stability, industry, ambition, ability to get along with others, loyalty, perseverance, maturity, leadership, and motivation."

(1) Name? (2) Telephone No? *Is this his own phone or someone else's?* (3) Present address? Length of time here? *Is this a desirable neighborhood? Too high class? Too cheap?* (4) Date of birth? (5) Place of birth? (6) Social security No?

(7) Have you been in the armed services? *If yes, go to serviceman's placement interview.* If not, why not? *Is there anything undesirable here?*

(8) Do you own a car? (9) What make? (10) Year and model? (11) Do you have sole use of your car? *Will he be able to use the car in selling?* (12) What is condition of car?

(13) Why are you applying for work in this company? *Is his underlying reason a desire for prestige, security, or earnings?*

Work experience. Cover all positions. This information is very important. Interviewer should record last position first. Every month since leaving school should be accounted for. Experience in Armed Services should be covered in supplemental form.

Last or present position? (14) Company? (15) From? To? *Do these dates check with his application?* (16) How was job. obtained? *Has he shown self-reliance in getting his jobs?* (17) Nature of work? Name of supervisor? *Will his previous experience be helpful on this job?* (18) Salary at start, at leaving? *Is this about what you pay?* (19) What promotions obtained or raises in pay received? *Has he made good work progress?* (20) What prizes, sales contests or other recognitions have you won? *Has he shown success in the work?* (21) What did you specially like about the job? *Has he been happy and content in his work?* (22) What did you specially dislike? *Were his dislikes justified?* (23) Reasons for leaving? *Are his reasons for leaving reasonable and consistent?* (24) Do you have any part-time jobs? *Will he be able to devote enough time to the job?*

Questions (14) to (23) inclusive are asked over again in reference to next to last and second to last positions. Previous employment is covered in a series of five questions with spaces provided for entries on five earlier jobs, including summer work while in school. Points covered are names and locations of employers, kinds of work, dates of starting and leaving and reasons for leaving. In asking questions on earlier jobs, interviewer considers: *Has he gotten along well on His jobs? Has he been consistent in the kinds of work or industries in which he is interested? Are his attitudes towards his employers justifiable? Has he shown ability to improve himself and his position?* The questions on previous employment end with (69). The form continues:

(70) What sales work did you like best? (71) Why? *Is he interested in creative selling? In work requiring activity?* (72)

Have you ever done house-to-house selling? How did you like it? *Is this enough to be of value? Were results satisfactory? Is his attitude right?* (73) If "no" to (72) How do you think you would like it? *Are his reasons acceptable? Are they consistent? Is his attitude right?*

(74) What knowledge or experience do you have in electric and gas utility work? *Selling? Servicing? Manufacturing?* (75) What knowledge or experience do you have concerning electricity or gas and their uses? *Will this be helpful?* (76) Are you free to work evenings? *Will there be handicaps in his path?* (77) Would you prefer to continue to work as a salesman or do you look forward to taking on supervisory responsibilities? Why? *Is he a "lone wolf"? Is there a definite urge to take additional responsibilities?*

(78) How many weeks have you been unemployed in the last five years? *Is this a reasonable period?* (79) How did you spend the time? *Did he use his time profitably?* (80) How did you support yourself? *Does he depend on himself?* (81) What efforts did you make to obtain work? *Is he inclined to search for work or responsibility?* (82) Have you ever drawn unemployment benefit compensation? (83) If yes, how many times? On what dates? For how long? *Does he want to be employed steadily?*

(84) Have you ever been on relief, CCC or WPA? (85) If "yes", Where and how long? *Whether on relief or not, does he show ambition through dissatisfaction with this type of work?* How did you like it? *Is he self-reliant? Is he passive? Weak?* (86) Have you ever been arrested, including traffic violations? (87) If "yes", how many times and what were the charges? *Were the charges serious or merely indicative of immaturity?*

Schooling. (88) How far did you go in school? Grade school, 1-2-3-4-5-6-7-8, graduated, High school, 1-2-3-4, graduate, College, 1-2-3-4, graduate? Where? Degree? *Is his schooling adequate for the job?* (89) Age at leaving school? (90) Date of leaving school? (91) If you did not graduate from high school or college, why not? *Are his reasons for not finishing sound?* (92) Did you take any courses by correspondence, at night or in a vocational school? Schools, courses, dates? (93) Were they completed? If not, why not? *Has he shown ambition by his efforts to improve himself?*

(94) While in high school in what activities did you participate? *Does he get along with others?* (95) What offices did you hold in any of these groups? *Has he shown leadership qualities?* (Questions (96) and (97) are repetitions of (94) and (95), in reference to college activities.)

(98) What was the principal source of your spending money while in high school and college? *Did he learn to earn money early in life?* (99) What part of expenses was earned during high school and college? Was money for schooling borrowed? Repaid? *Has he shown habits of industry and self-reliance while in school?*

Family background. (100) What was the occupation of your father? (101) Number of children in family? (102) Number older? (103) Number younger? Who raised you? *Was he the "baby" of the family?* (104) Was it necessary for you to help your family when you were growing up? *Did his early experience strengthen his character?*

(105) How did you spend your summer vacations while a boy? *Do his boyhood activities indicate ambition?* When did you first start to earn all your own living expenses? *Did he learn to be self-reliant while young?* (106) How did you spend your leisure time after school and on Saturdays? *Did he form habits of industry and responsibility?* (107) Did you belong to any church clubs, 4-H Clubs, Boy Scouts, or similar groups while a boy? *Did he get along with other boys?* (108) Did you hold any positions of leadership in these groups? Did you win any awards, prizes, etc? *Did he show leadership as a boy?*

Present financial situation. (109) Do you own or rent your home, live with relatives or board? *Is this a motive for working hard?* (110) If home is owned, what is its value? (111) Are you carrying a mortgage? *Is this consistent with his past and future earnings?* (112) If home is rented, how much rent is paid? (113) Do you own your furniture? *Does this condition indicate stability?* (114) How much do you estimate it costs you to live per month? (115) Do you have other indebtedness than current living expenses? *Is he financially responsible?* (116) Have you ever been bankrupt? (117) Have you ever been refused bond? *Will he submit to being bonded?* (118) Has your salary ever been garnished or assigned? If "yes", what were the circumstances? *Is he mature financially?* (119) Have you ever patronized small loan agencies? What for? *Is he mature financially?* (120) In your last position were you able to save any money? *Is he frugal and provident?* (121) Do you contribute to the support of your parents, relatives or others? (122) If "yes", how much? *Does he have other financial incentives for working?*

(123) Do you have any other source of income? (124) If "yes", specify. *Will this other income affect his motivation?* (125) Is your wife employed? (126) If "yes", at what kind of work? *Will this offset his motivation?* (127) Is it steady? (128) Earnings? (129) How long has she been employed there? (130) What are her hours? *Would our company working hours conflict with his wife's hours?* (131) Are any other members of your family living in your home employed? (132) If "yes", what kind of work? (133) Earnings? *Will this influence his activity or his motivation?* (134) Do you carry life insurance? *Yes?* (135) Accident? *Yes?* (136) Car? *Yes?*

Domestic and social situation. (137) Married, single, widowed, divorced, separated? (138) Date of your marriage? (139) Number of dependents? (140) Ages? *Irrespective of status, is there favorable motivation?* (141) What is your father-in-law's occupation? *Is wife's family on about same social plane?* (142) Do any of your wife's or your relatives live with you or close by? (143) Is your home life congenial and happy? *Do his or her relatives approve of work with our company?*

(144) Are you and your wife living together? (145) Have you ever been separated? Why? *Are he and his wife compatible?* (146) Have you been married previously? (147) If "yes", how many times? (148) What happened to previous marriages? *Do his domestic difficulties indicate immaturity?* (149) In case of divorce, if there were children, who was awarded them? Why?

(150) To what lodges, clubs or fraternal organizations do you or did you belong? (151) What positions have you held in them? *Does he show leadership?* (152) What do you do for recreation? *Do recreations show maturity?* (153) Do you have any hobbies? *Will his hobbies help his work?* (154) To what extent do you and your wife entertain? *Does he seem socially well adjusted?* (155) What is your wife's or family's attitude towards sales work? *Do they approve?* (156) What is your wife's attitude towards your working evenings after six o'clock? *Will this help him? If single, will he give up his evening social life?* (157) Do you drink intoxicating liquor? (158) To what extent? *Is this sensible drinking?* (159) Are there any kinds of people, religious denominations, nationalities, or racial groups you actively dislike? *Is he unbiased? Will he be successful in any assigned territory?*

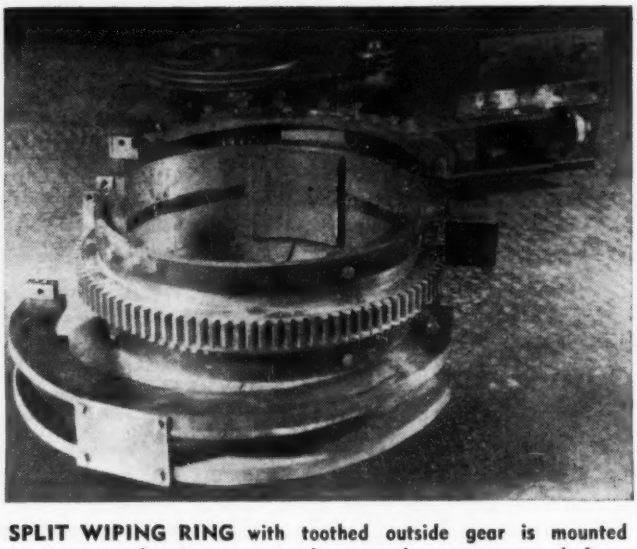
Health. (160) Did you have any serious illnesses, operations or accidents as a child? *Has he outgrown any infantile personality traits due to childhood illness?* (161) What illnesses, operations or accidents have you had in recent years? *Are his illnesses legitimate rather then indicating a tendency to "enjoy ill health"?* (162) Do you suffer from defect in speech? (163) Hearing? (164) Sight? (165) Rupture? (166) Have you a history of tuberculosis? (167) Nervous breakdown? (168) Rheumatism? (169) Asthma? (170) Foot trouble? (171) Heart trouble? (172) Hay fever? (173) Highblood pressure? (174) Diabetes? (175) Ulcers? (176) Other? *Is he able to do a full day's work?* (177) Are you subject to colds? (178) How much time have you lost from work during the past year because of illness? *Is he relatively healthy?* Does anyone in your home suffer from ill health? *Are his wife, children, family relatively healthy?*

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Scored Journal Bearing Resurfaced on the Job

LAPPING RIG for generator bearing journals. Steel ring with polishing shoes was rotated by motor-driven gear box



SPLIT WIPING RING with toothed outside gear is mounted in temporary bearing so as to be rotated on generator shaft

H. A. NOBLE
Mechanical Supervisor
Southern California Edison Co
Los Angeles

THE PROBLEM of repairing a badly scored journal and shaft recently confronted Southern California Edison Co. This damage resulted from a penstock break at one of its Big Creek hydro plants. Debris, washed into the power house as a result of the break, practically covered the bearing housing. This blocked the governor and the unit ran until the penstock emptied. Water and fine sand entered the bearing oil and scored the journal. Bearing damage necessitated installation of a spare.

A rotating lapping rig was made up on the job. This consisted of a split steel cylinder with three steel-backed babbit laps inside. It was rotated by motor-driven gears at approximately 26 rpm. Two of the surfacing laps were mounted firmly on the inside of the revolving ring; the other floated on springs strong enough to hold the laps tightly against the journal.

The whole assembly weighed 740 lb and was suspended from the power house crane. A compressed spring arrangement counterbalanced the weight so that the polishing would be done evenly around the journal. Carborundum finishing compound No. 41, with kerosene as a lubricant, was used for polishing. The job was completed in about 32 hr with a diameter reduction of about 0.006 in. due to the polishing.

• • •

Insulation Test on O.C.B. Current Transformers

BUSHING-TYPE current transformers used with oil circuit breakers have insulation resistance measured systematically by an eastern utility. The work is done at the terminal block. If the values do not exceed 1 megohm, the transformers are separated from the cable at the terminal block. Leads are "cleated" with good insulating material at each terminal block. This will prevent crossing up leads when they are reconnected to terminal blocks after testing. Transformers and cables are then tested separately by a Megger-type instrument. If the separated current transformer measures under 1 megohm, the leads between the transformer and terminal block are disconnected. This is done as close to the current transformer as possible. Transformer and leads are then tested separately. If either item measures under 1 megohm after this separate test, the maintenance department office is asked for further instructions. Experience has shown that poor bushing gaskets have been the source of most of the company's troubles. If time does not permit a long outage, the bushing type current transformer is removed, washed with carbon tetrachloride and exposed to sunlight or

heat for a short time. The baking and varnishing can be done later.

It is obviously necessary to disconnect any ground connections that may exist, either at the oil circuit breaker or switchboard, before any insulation resistance testing is done. Care must be taken that all ground connections are tight on replacement.

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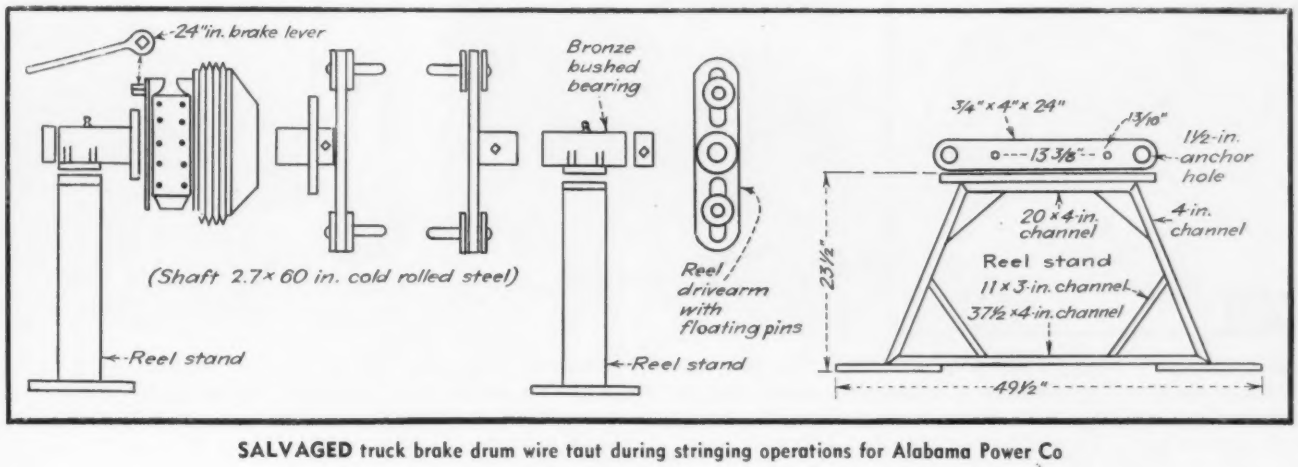
Truck Brake Controls Wire Reel



SALVAGED truck brake drum wire taut during stringing operations for Alabama Power Co

INGENIOUS USE of a salvaged truck brake drum solved the problem of keeping wire taut during stringing operations for Alabama Power Co. Simplicity in construction, efficiency in operations and ease of attachment to the reel are the main features of the device shown in the above sketch.

D. D. McCracken, in charge of construction equipment, devised the reel stand on which a brake unit from a 1½-ton Ford truck was used, converted to cam action. Maximum pressure used was 20 lb, but the brake lever can exert as much pressure as the wire will stand before breaking.

The ground plates for the reel frames are 12 in. square and have 3½-in. holes for the necessary ground pins.

The job on which the device was used was construction on the Parkwood-Mobile Junction 12 kv line in Jefferson County.

• • •

Clearing Water-Cooling Coils Internally

SCALE or sediment formed in water-cooled transformer tubing can be removed without taking the coils from the tanks. An Eastern utility has an established procedure to do this. Deposits are indicated by higher than normal top temperatures of the oil and reduced water flow, water pressure remaining the same. Compressed air is useful in removing sediment other than scale. To accomplish this, the coils are first drained, refilled with water, and air at 90 psi used to blow out the water. The air blast is continued a few moments after all water is out. This is partly effective where the sediment is flocculant. Flocculant sediment does not interfere appreciably with the flow of water or transfer of heat from the oil to the water in the tubing.

If solidified sediment or scale has been deposited in the cooling coils, the best method of removing either is by using acid. It is not necessary to remove such coils from the tank. The procedure follows: (1) Shut off the inlet and outlet valves that disconnect the transformer from the water system. (2) Open the drain valve and blow all water from the coils by compressed air. (3) Prepare a solution of equal parts water and commercially pure, 22 Baumé (1.179 sp gr), hydrochloric acid in a barrel. The resulting specific gravity of this solution should be about 1.10. (4) Add 1 percent by volume of an inhibitor (such Quinoline). (5) Connect a pipe tee, valve and hose from the drain valve to the barrel. (6) Connect the other drain valve through a pump and hose to the barrel. (7) Install a section of ¾-in. pipe in the tee, rising vertically to a point above the highest part of the cooling coils. This will serve to relieve pressures and surges caused by chemical reaction between the acid and the deposits. (8) Pump cooling coils full of the solution and shut off the two drain valves. The chemical action may be violent. (9) After the solution has stood in the coils until the chemical agitation ceases, drain the coils of the solution by discharging upon the ground. Flush out the coils thoroughly with clean water. If all scale is not removed the first time, repeat until the coils are clean, using

a new solution each time. Usually one or two fillings suffice. (10) After all deposits have been removed, the coils should be flushed with clean water for at least 15 min. Test a sample of this water for acid-alkaline reaction. This can be done by using one drop of universal indicator in a sample of water from the coil. The color is compared with that of a sample of tap water to which a drop of indicator has been added.

• • •

Dolly Cradle Carries Distribution Transformers

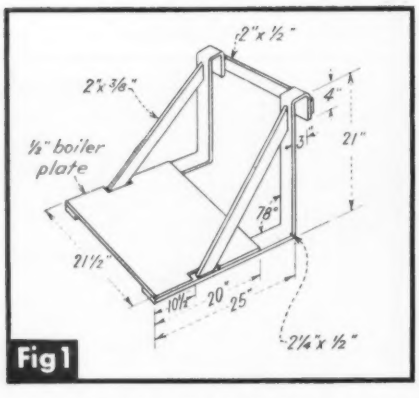


Fig 1

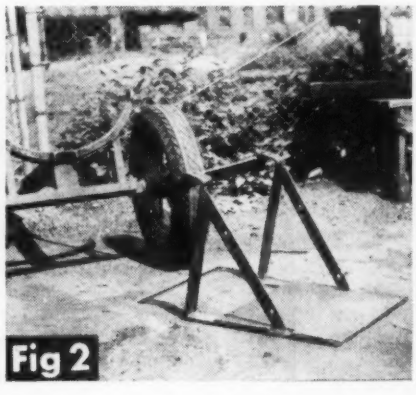


Fig 2

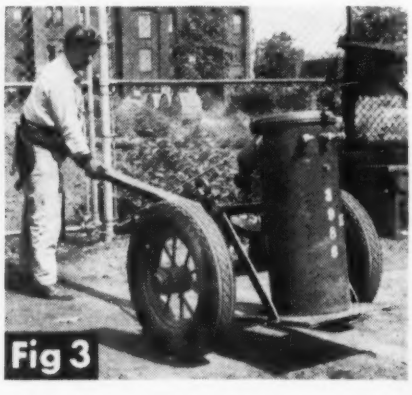
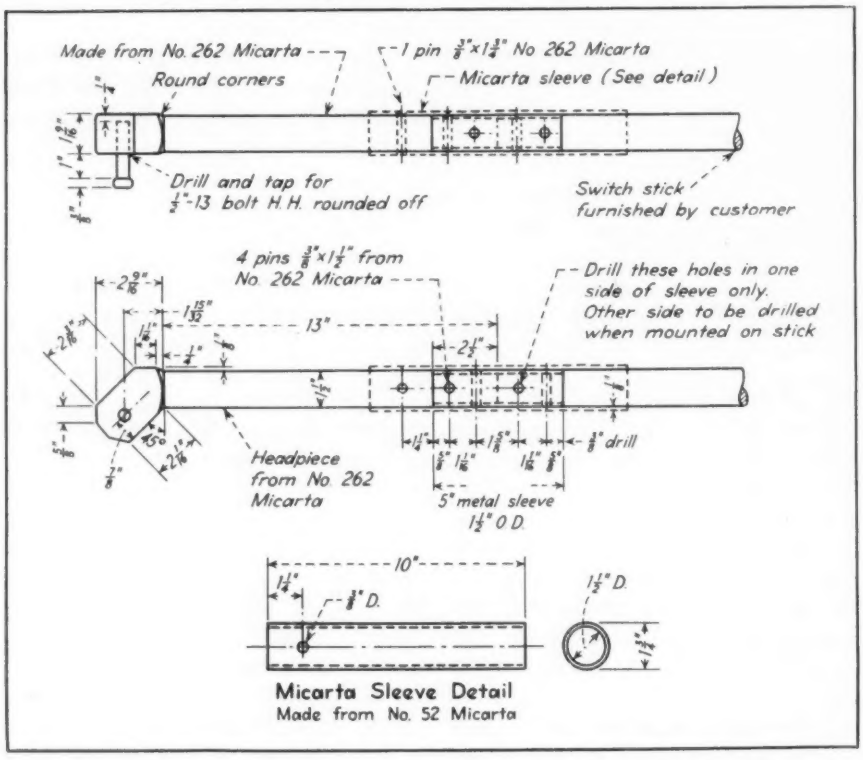


Fig 3

AN ORDINARY POLE-CARRYING DOLLY can be used to transport distribution transformers. The strap-iron cradle (Fig 1) illustrated fits easily over the crossbar supports above the nested leaf springs (Fig 2). The cradle frame supports a 21½-in. x 20-in. boiler plate platform capable of holding a transformer up to 75 kva rating. One man can pull the dolly (Fig 3) on level ground with ease. This does away with handling transformers by truck hoists in transporting many common sizes.

• • •

Heavy Duty Head for Switch Stick


Made from No. 262 Micarta
Round corners
1 pin ⅜"x1¾" No 262 Micarta
Micarta sleeve (See detail)
Drill and tap for ½"-13 bolt H.H. rounded off
Switch stick furnished by customer
4 pins ⅜"x1½" from No. 262 Micarta
Drill these holes in one side of sleeve only. Other side to be drilled when mounted on stick
13"
2½"
Headpiece from No. 262 Micarta
⅜" drill
5" metal sleeve 1½" O.D.
10"
1¼"
⅜" D.
1½" D.
Micarta Sleeve Detail
Made from No. 52 Micarta

NON-METALLIC HEAD for 1.5-in. switch sticks up to 2,000-amp service designed by New England Electric System.

TO PROVIDE satisfactory operation of switch sticks when opening disconnects up to 2,000-amp capacity, the New England Electric System, Boston, designed the head shown. The tang has been offset to assist in getting a straight pull. This tang is made of ½-in. diam steel. The head piece and sleeve are of Micarta, with details as shown.

H-F Discharge Tests Plastic Lining Leaks

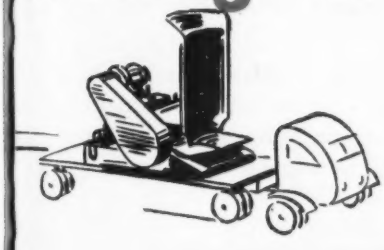
B. W. WHITEHURST*

ALL PLASTIC LININGS for interior surfaces of metallic process vessels have fairly high dielectric values. Among these are low-temperature thermoplastics available in sheets $\frac{1}{16}$ in. or over. The high dielectric values of such plastic coatings facilitate tests for minute holes and cracks invisible to the eye. Such defects may be large enough to permit fluids within the vessel to penetrate and attack the metal exterior.

A highly efficient method of testing is by applying high-frequency discharges generated by a 100-w universal therapeutic unit. These are usually available for about $8 at most drug and department stores. The discharge electrode should preferably have a rounded end to prevent scratching the lining. When moved slowly above the surface being explored, a characteristic discharge bridges from the electrode and localizes at the defective point in the lining. During exploration, the electrode should be maintained from 2 to 3-in. above the surface.

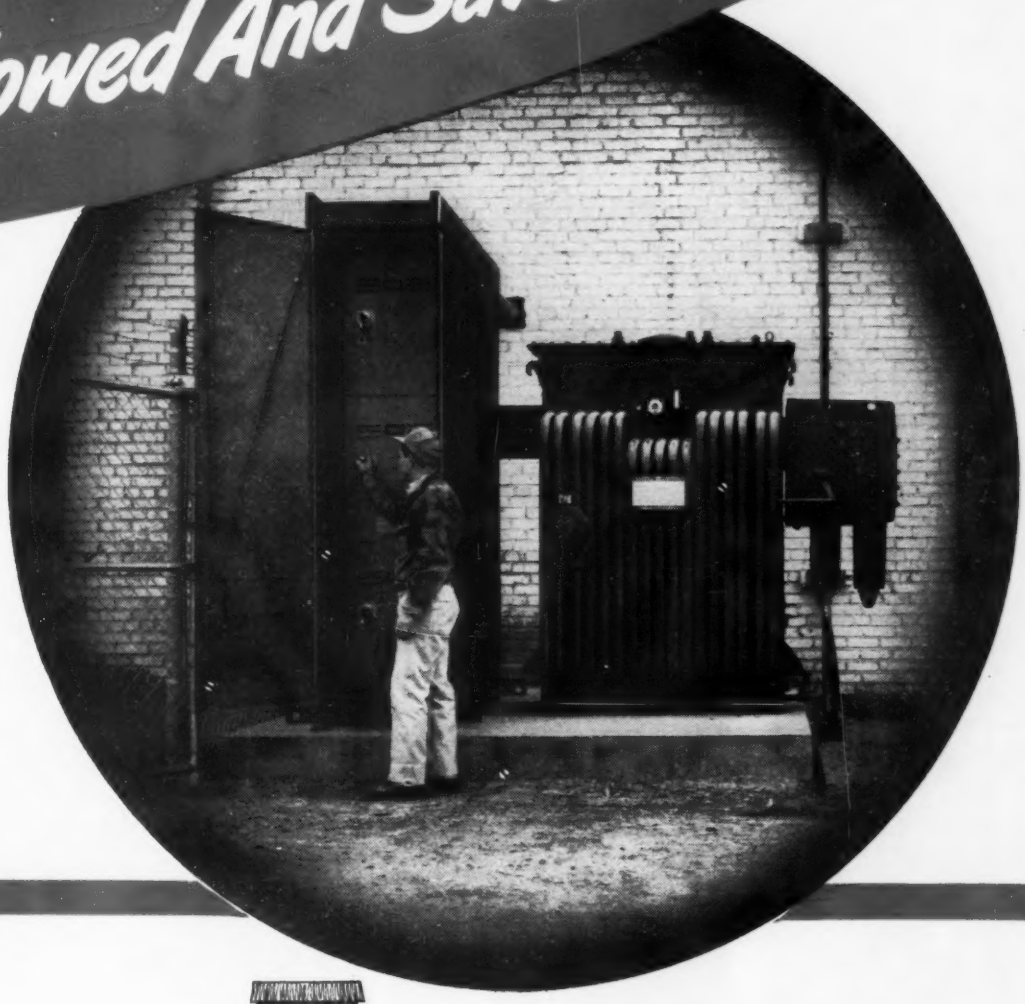
*Industrial Division, Stone & Webster Engineering Corp, Boston, Mass.

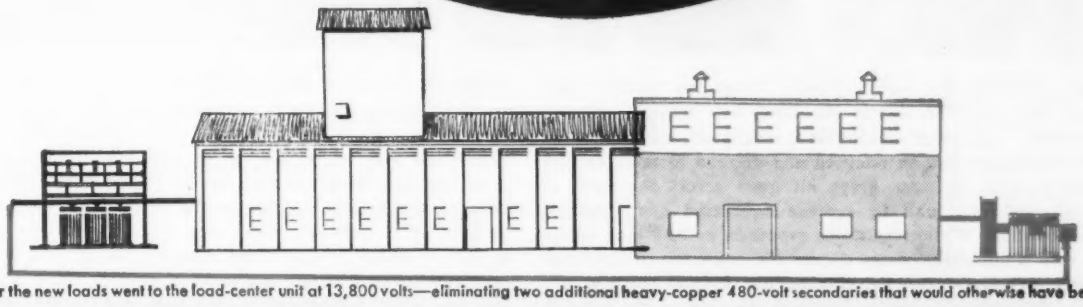
'wrong' way



The electric load moved away from the main substation instead of toward it, as originally planned. As a result, heavy secondary conduits reached out 500 feet. New equipment to be installed would have required two more of these heavy secondary cables—at $2000 each.

Followed And Saved $3000!





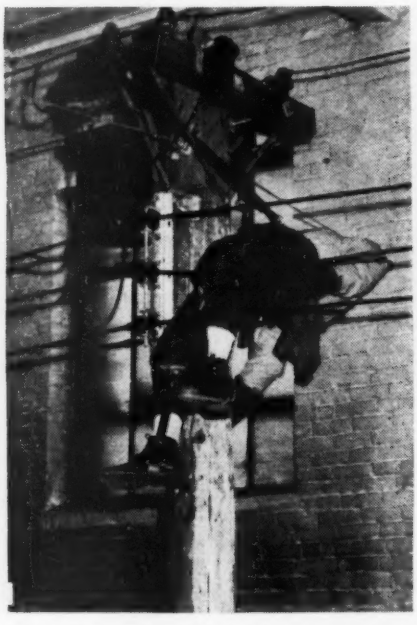
Power for the new loads went to the load-center unit at 13,800 volts—eliminating two additional heavy-copper 480-volt secondaries that would otherwise have been needed.

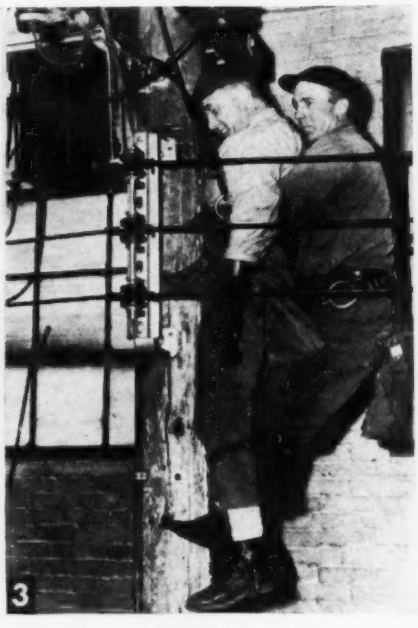
Pole Top Resuscitation

A rescue method is outlined as taught by the Western Massachusetts Electric Co

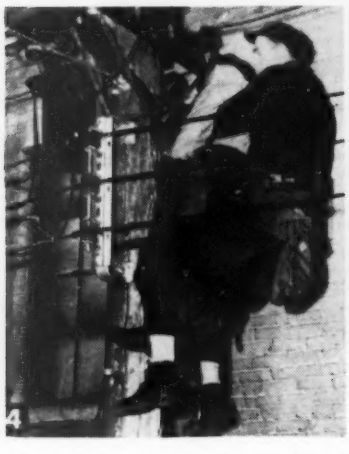
INSTRUCTION is given indoors on a pole line carrying a primary circuit, secondary conductors, transformer and other overhead equipment. The "class room work" is under the general supervision of E. H. Wessels, Jr, safety director, Springfield Chapter, American Red Cross and B. J. Dowd, division superintendent of the distribution department at Springfield.

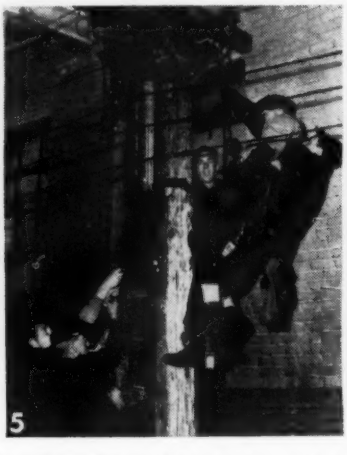
Accompanying illustrations show various steps in rescuing a lineman who has become "unconscious" from contact with a supposedly energized primary.





1—While working on high-voltage wires at top of pole, lineman's arm hypothetically came in contact with wire. This caused unconsciousness and breathing stopped. As he fell backward, one leg came in contact with a secondary conductor. The weight of his body is held by the safety belt. . . 2—Rescuer climbs pole and clears victim from live conductors. He protects himself and allows victim to hang by safety belt. Here is shown the first position of the rescuer as he brings his own safety belt up the pole between the victim's legs. . . 3—Rescuer brings his own body close to the victim so that he can raise his safety belt high on the pole and tight in the victim's crotch. The rescuer should guard against coming in contact with the energized conductor





4—Rescuer, holding the victim tightly, drops his weight back away from the pole. This causes his safety belt to pull taut and lift the victim. This takes the victim's weight off his own safety belt. The victim can now be released and allowed to relax against the rescuer's chest. Rescuer wraps his arms across the front of the victim's abdomen, and by rythmic squeezing and releasing starts resuscitation. While respiration proceeds, a third man climbs the pole with a bull line; passes it over the crossarms and through the victim's crotch, through the ring on one side of the rescuer's belt, under the rescuer's buttocks, through the ring on the opposite side of the rescuer's belt and back through the victim's crotch. A bowline knot is tied in the line. The ground crew takes the weight of the victim and the rescuer on the bull line, so that the rescuer's safety belt can be unhooked. This allows victim and rescuer to ride free on the bull line. Respiration is continued throughout the entire process of lowering. . . 5—The ground crew lowers both victim and rescuer to the earth. The third man remains on the pole to prevent the descending pair from swinging or twisting. . . 6—As victim and rescuer reach the ground, their weight is taken by the three men on the ground and they are carefully lowered. Close attention is paid to avoid interference in any way with respiration. Victim and rescuer are rolled over by the ground crew. Rescuer is placed in position to start the Schaeffer prone-pressure resuscitation process.

fluorescent ballasts

The ballast is an important part of your fluorescent fixture. The reputation of your fixture can depend on its performance.

Is it quiet? Will it stay that way? Will it assure rated lamp life, rated lamp output? Is it designed to operate dependably for the life of the fixture?

The answer is "yes" if you use G-E "lamp-matched" ballasts! Thirty-three million G-E ballasts are now proving how they *keep* fluorescent fixtures sold.

Happy marriage

. . . with your fixture. Yes, G-E ballasts are worthy companions for your finest fixtures. Remember, to get the right mate for a lasting match —a *profitable* match for you, choose G-E ballasts. Quiet, *long-lifed,* "lamp-matched" to get the most from any standard lamp, they will "live happily ever after" with your fixtures.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

BALLASTS
CABLE
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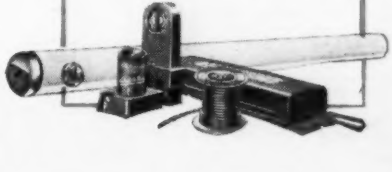
for
DEPENDABILITY
In fluorescent lighting



GENERAL ELECTRIC

412-11

Secondary Distribution Design*

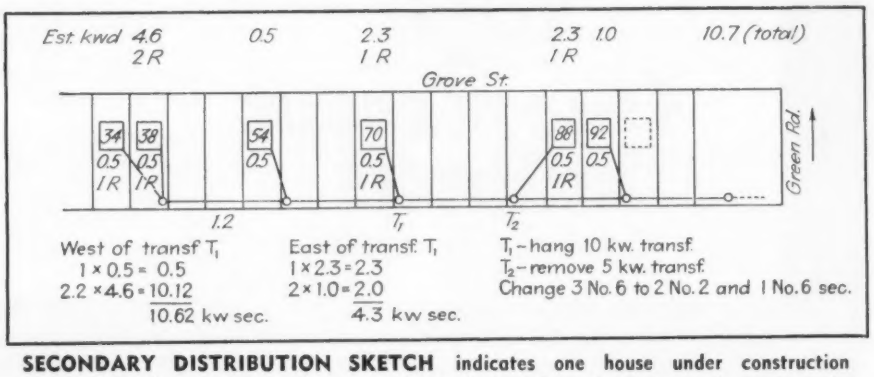
H. C. BINGHAM
Electrical Engineering Dept
Cleveland Electric Illuminating Co
Cleveland, Ohio

A method of designing urban lighting distributions, for use by non-technical personnel. It gives very good average results at lower over-all cost than if each job is engineered specifically.

Basic design conditions: (1) Urban lighting distributions designed to deliver 112 to 118 v (2) Each feeder is regulated and runs direct to the load center. (3) Compensation provides for all the drop in feeder circuit, some of the drop in primary mains, and some of the transformer and secondary drop. (4) Distribution transformers are loaded to 125 percent of name-plate rating, and more than that during the Christmas peak. (5) Secondaries designed for about 1 percent drop based on loads balanced across 3-wire Edison distribution. (6) Loop or service wires designed for up to ½ percent drop. (7) All of these drops based on estimated normal winter loads shown in Tables I and II. (8) Except for range loads, no attempt is made to use different diversity factors, since the number of customers varies per distribution. (9) Average pole spacing for secondaries is 125 ft, and any spacing between 100 and 150 ft is called a normal section. Table III lists kilowatt-sections which will give about 1 percent drop for lighting loads. Instructions accompanying the table are based on economics, on assured 115-v motor starting, and on satisfactory appliance operation.

With the accompanying tables as a reference, an electrical sketch is made showing the estimated load for each pole and range customer (R). Pole spacing less than 100 ft or more than 150 ft is indicated in fractions of sections. Trial transformer locations fix actual location in obtaining equality of total electrical moments each way from the transformer. This is accomplished by multiplying kw load on each pole by the number of sections between that pole and the transformer.

The transformer pole is indicated (T). When maximum kilowatt-sections are six or less, three No. 6 wires can be specified providing the larger wire will not be needed for more than ten years. If there is land for future building, or if kilowatt-sections are more than six but not over twelve, two No. 2 and one No. 6 secondary conductors can be specified. Transformer size is determined by totalling load estimate and installing a transformer rated at least 80 percent as large. Until loads get larger than 12 kw per pole, wire larger than No. 2 should not ordinarily be used.



SECONDARY DISTRIBUTION SKETCH indicates one house under construction (shown dotted) and six 7- or 8-room residences in a high-grade territory. A check of the 3-wire loops shows four range customers

TABLE I
Lighting and Small Appliance Loads
(Consider each half of a double house or apartment suite as an independent building of the proper number of rooms)

No. of Rooms in Residence or Suite	Kilowatt Demand	
	Average Territory	High-Grade Territory
6 or less	0.40	0.45
7—8	0.45	0.50
9—12	0.50	0.60
Over 12	....	0.80

For each apartment hall add 0.20 kw. For store or gas stations loads, figure connected lighting load. For motors ½ hp and larger, add 1.00 kw per hp. (If many such motors, only include half of them).

TABLE II
Range Demand in Kw for each range
(This is for residential ranges rated 12½kw or less.)

No. of Ranges	Kw Demand per Range	No. of Ranges	Kw Demand per Range
1	3.5	5	1.7
2	2.3	6	1.5
3	2.0	7	1.4
4	1.8	8	1.3
		10	1.25

TABLE III
Lighting Secondary Distribution
(Data is based on 125-ft average section lengths)

Secondary Wire Size, A W G—Copper	Max Kw Sections Permitted
3 No. 6	6
2 No. 2 and 1 No. 6	12
2 No. 1/0 and 1 No. 2	18
2 No. 4/0 and 1 No. 1/0	30

Wire larger than No. 2 should not ordinarily be used.
Secondaries shall not extend more than 500 ft from transformer.
Wire size may be installed for load growth over 10 yr, but install transformer for present load only.
Only use 1½-kw transformer to serve one customer and then only if he has a 2-wire loop.

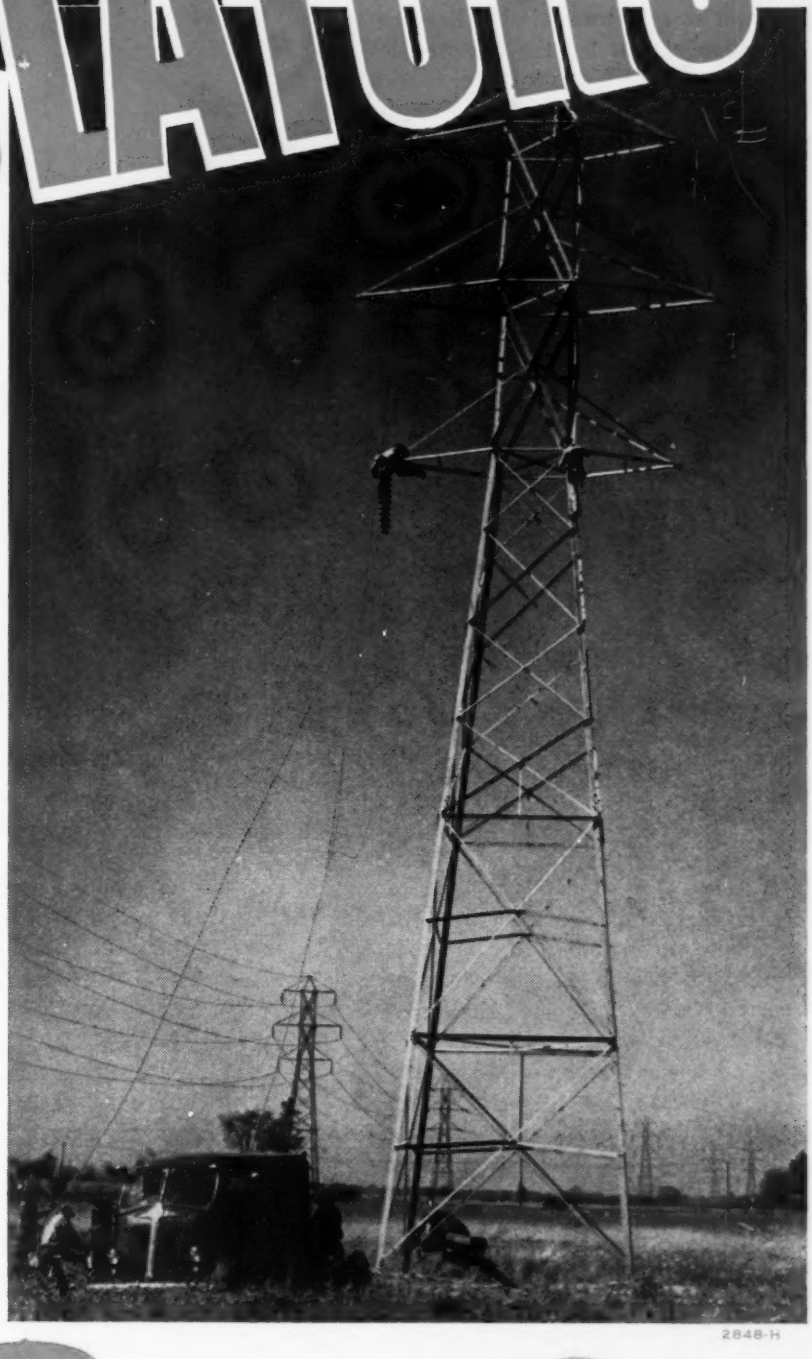
TABLE IV—Lighting Loop Sizes

Loop Size	Max Kw Demand Carrying Capacity	Maximum Kw Demand for These Loop Lengths (ft)					
		50	75	100	125	150	175
2 No. 8	..	1.0	0.7	0.5	0.4	0.3	....
2 No. 6	..	....	1.0	0.8	0.6	0.5	0.4
2 No. 2	..	....	....	....	....	....	1.0
3 No. 8	10	4.0	2.6	2.0	1.6	1.3	....
3 No. 6	15	6.0	4.0	3.0	2.5	2.0	1.7
2 No. 2 & 1 No. 6	25	14.6	9.7	7.3	5.8	4.9	4.2
2 No. 1/0 & 1 No. 2	40	21.4	14.3	10.7	8.6	7.7	6.1
2 No. 4/0 & 1 No. 1/0	70	36.7	24.5	18.3	14.7	12.2	10.5

A 3-wire loop shall supply a residential building with four or more circuits. If loop is directly off the transformer, the above kw demand figures may be tripled within the carrying capacity of the wire

* An adaptation from a paper presented before Edison Electric Institute at Atlanta, Ga.

POWER CUSTOMERS INSULATORS



Reliability of O-B insulation of every class on this large metropolitan system serving 60 separate communities • •

• • • • *has pointed to the continued preference for O-B on this, and other new construction in progress, to better serve the needs of over a million power customers.*

2848-H

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Company, Limited
Niagara Falls, [illegible] Ontario

HEADQUARTERS FOR PORCELAIN INSULATION

Suspension Clamp Power Loss Tests

ALFIO BISSIRI
Transmission Design Section
Department of Water & Power
Los Angeles, Cal.

INTEREST in the magnitude of the power loss in transmission line suspension clamps led the Los Angeles Department of Water & Power to conduct tests recently to determine the magnetic losses. The results, presented here were quite revealing, particularly the tests on two makes of aluminum clamps which showed losses reduced almost to nil.

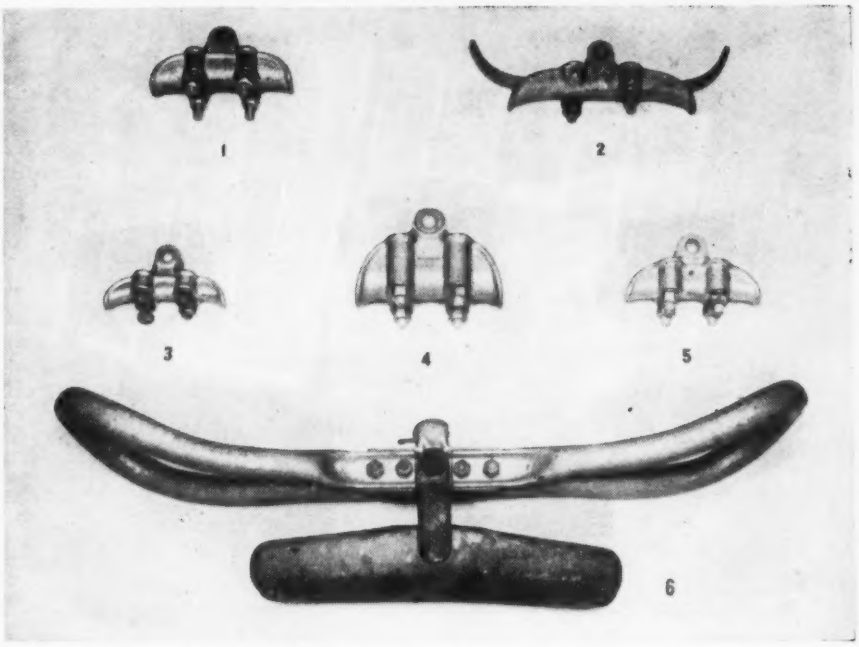
Types of Clamps

Types of clamps tested are shown in the accompanying photograph. No. 1 is OB No. 78676, No. 2 is OB No. 70701; both these clamps have the body, keeper, bolts and pin made of malleable iron. No. 3 is OB Drawing No. 85469. It has a body and keeper of malleable iron with Everdur U-bolts and Duronze pin. No. 4 is W. D. Howze and Co clamp, with body and keeper of aluminum alloy, U-bolts and pin of steel. No. 5 is OB No. 85658, with body and keeper of aluminum alloy, U-bolts and pin of steel. No. 6 is the clamp developed by the Department for the Boulder 287.5-kv line.

Test Procedure

Each clamp was tested by assembling it on a loop of 500,000-cir mil bare copper conductor, except clamp No. 3, for which a smaller size cable was used. Suitable leads were bolted to the conductor and connected to the source of power. Current was circulated through the conductor by means of a low-voltage, high-current transformer. Measurements of total power consumed in the conductor circuit were made with a low power-factor dynamometer indicating wattmeter. The current coil of the power instrument was supplied from a metering current transformer in the conductor circuit. The 7.5-v range of the wattmeter potential circuit made possible direct connection across the conductor circuit. Actual voltage on the circuit was of the order of 1 to 1.5 v.

Watts loss in the clamp was determined by the difference in wattmeter readings of the circuit with and without the clamp. The test was made at 60 cycles. An accuracy of 7 percent or better was obtained with the method used.



SUSPENSION CLAMPS TESTED in power loss measurements, above, are: No. 1, OB clamp No 78676; No 2, OB clamp No 70701; No 3, OB clamp Dwg 85469; No 4, W D Howze & Co aluminum clamp; No 5, OB aluminum clamp No 85658 and No 6, Boulder HH Clamp.

TABLE I—Summary of Losses in Suspension Clamps

Type of Clamp	Line Amperes	Watts Loss
No. 1 OB 78676	300	26.4
No. 2 OB 70701	300	18.6
No. 3 OB 85469	300	8.7
No. 4 W. D. Howze & Co	300	0.6
No. 5 OB 85658	300	0.3
No. 6 Boulder H-H clamp	300	9.0

TABLE II—Breakdown of Suspension Clamp Losses

Type of Clamp	Line Amp	Watts Loss
No. 1 OB 78676	300	26.4
" with pin removed	300	24.0
" with wood keeper	300	15.6
" " " " and pin removed	300	11.4
OB 78676	200	10.4
"	400	37.6
No. 2 OB 70701	300	18.6
" with pin removed	300	17.4
" with wood keeper	300	15.6
" " " " and pin removed	300	11.4
No. 3 OB 85469	300	8.7
" with steel U-bolts	300	16.5
" with steel U-bolts and pin	300	18.3
" " " " " "	200	8.4
" " " " " "	400	34.4
" " " J-bolts & pin	300	15.9
No. 6 Boulder H-H	300	9.0
" " less arcing horn	300	7.2
" " less arcing horn and pin removed	300	5.4

Test Results

A summary of results is shown in Table 1.

In order to determine the effect of the component parts of the clamps on the total losses, readings were taken after the removal of each of the parts making up the clamp. The clamp No. 1, or OB 78676, with a line current of 300 amp, had a loss of 26.4 w. Removing the pin decreased the loss to 24.0 w. Replacing the pin and

FIRST...
THE ENGINEER'S PROBLEM...

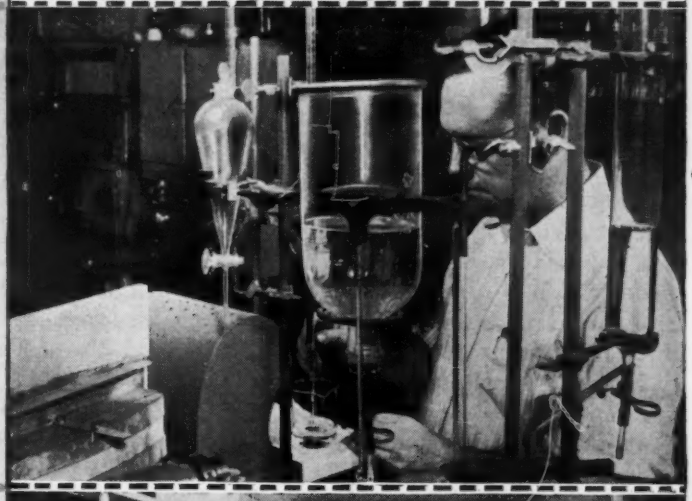
Your specifications of winding capacities and voltages must be translated into terms of cores, windings, insulation, bushings, terminal boards, tap changers... and many other items of design. Moloney engineers know the right answers. At their fingertips are the Moloney files... *fifty years in the making*... a veritable gold mine of information.

NEXT, THE DRAFTSMAN...

Taking the engineer's electrical design, the draftsman must develop the mechanical design, which includes the core clamping structure, lead supports, terminal boards and other items necessary for a complete core-and-coil assembly. In locating the various parts, he must provide adequate electrical clearance and creepage to prevent internal flashovers. Next, the tank must be designed and the size and number of cooling tubes or radiators calculated. These are but a few of the details where Moloney's experience really counts.

THE LABORATORY... TROUBLE SHOOTING BEFORE TROUBLE CAN BEGIN...

It is here that the raw materials... the steel, the copper, the oil, the insulating materials, etc., are tested to determine whether they meet Moloney specifications. Materials are checked in advance of use... in effect, trouble shooting before trouble can begin. Here in the Moloney Laboratories experienced engineers and technicians, using modern equipment and new techniques, pre-test raw materials in order to insure the trouble-free, uninterrupted operation you expect from your Moloney Transformers.



ENGINEERING DEPARTMENT...

Moloney's highly trained engineers are skilled in every phase of transformer theory and practical application. The "blueprinting" of a Moloney Transformer is no one-man job... it is a job that utilizes the combined know-how of many specialists, each an expert in his field of transformer design. Moloney's large staff of experienced engineers can design transformers to meet *your* particular requirements... and which will provide many years of reliable service.

substituting a wood keeper decreased the loss to 15.6 w. Removing the pin and with the wood keeper, the loss was ultimately decreased to 11.4 w.

The same procedure was repeated for the other clamps. Results are shown in Table II. Table II also shows the loss due to 200 amp and 400 amp for clamps No. 1 and No. 3.

• • •

Relay Curve Templates Made from Plastics

(Relay Test Card #1)

N26-1503 Relay at Fourth St. Sub Sta on 6900 v Cir. No 417

Make: G.E. Type: IA-201 Service: O.C. Cir. Name Sacandaga Co.

Cat./Mod./S. No. — N.P. No. 26703 Single/~~Poly~~ phase Tests Req'd.: Nos. 6, 21 & 53

Performance Curves: — Target Coil, Amps: 2.0 Ohms: 0.25

Recommended Adjustments and Settings	
(*) Kind	(†) Taps, etc.
Amps.	4-5-6-8-(10)
Time Lev.	Approx. 9½ (See Curve)

Top Element on Upper Half/~~Quart~~ of Panel, in Phase # 1

(Panel in 3rd pos. from East to West on 6900 v. side)

Circuit Breaker Make: G.E. Type FKR-132-C

Amp 600 Volts 15,000 with Manual Op. Mech.

and 24 v. D.C. Trip, thru aux. relay: — P.T. — —

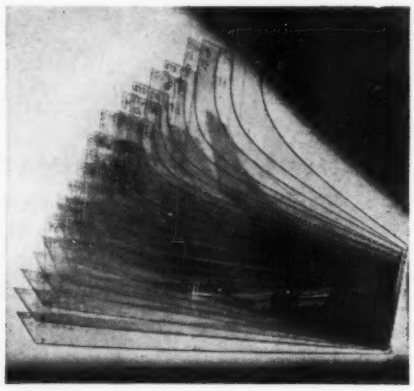
C.T. Ratio: 300 : 5 Make: G.E. Type: K-81

(C.B. in 3rd pos. from East to West on 6900 v. side)

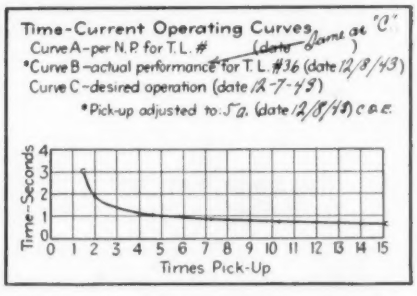
Found	Left	Date	Tester	Found	Left	Date	Tester
Note 1	O.K.	12/8/43	C.O.E.				
O.K.	O.K.	5/25/44	C.O.E.				
O.K.	O.K.	12/29/44	C.O.E.				
O.K.	O.K.	6/12/45	W.O.F.				
O.K.	O.K.	1/3/46	W.O.F.				
O.K.	O.K.	7/8/47	W.O.F.				

(*) State which: Amps., Volts, Ohms, Impedance, Core Screw, Time Lever, Inst. Trip attachment, etc. (†) Draw Circle about tap, etc., actually in use.

FACE OF RELAY TEST CARD. Tester puts "O.K." in second column when relay described has met tests designated. Any difficulties are explained on the auxiliary card



BACK of relay test card carries time-current operating curve


Time-Current Operating Curves
Curve A-per N.P. for T.L. # (date ~~June~~ at "O")
*Curve B-actual performance for T.L. #36 (date 12/8/43)
Curve C-desired operation (date 12-7-43)
*Pick-up adjusted to 5a. (date 12/8/43) C.O.E.
Time-Seconds
0 1 2 3 4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Times Pick-Up

AUXILIARY TEST CARD contains workers' comments on the operation of the relay in question

THE RADIAL SYSTEM used by an Eastern utility requires few complicated relay schemes. But close coordination of scores of induction-disc over-current relays is necessary. This is because outlying substations are generally supplied from an inlying location and it is important to avoid excessively high settings at the generating plants. Each relay is set to perform in accordance with the same current-time curve that was used in calculating the desired selectivity.

Since no commercial card had the cross-hatching necessary to show the required operation of each relay, one was developed. A 7-in.x9-in. card was big enough to carry complete relay identification, recommendations and several years of test reports. Cross-hatching for the current-time curve on the back of the card was done by photo-offsetting a piece of cross-section paper having ten divisions per inch.

To make templates for reproducing the many time-current curves involved, all curves were plotted on the backs of a few of the relay cards. It was impracticable to use fractions of time-lever settings smaller than one-half, so about 20 curves were drawn for each sort of relay. A template for each desired operating curve was made using following procedure:

1. Large sheets of a transparent plastic about 30 mils thick were cut into 7-in.x9-in. pieces.

2. With the plastic held in register over a desired relay curve, the time and current axes were traced with a straight-edge and scratch-awl. (Relay make, type, general characteristic, time-lever number, etc, were also

(Relay Test Card #2) Sheet No. — 1 —

Comments on Operation of Relays

at Fourth St. Sub. Sta. — 6900 — v. Side

Comment No.	Comment Date	Relay No.	Relay Make	Comments (followed by initials of Tester)
1	12/8/44	N26-1503	G.E.	Pick up found low. Adjusted to 5a. O.O.E.
2	5/25/44	N26-1571	G.E.	Replaced cracked jewel. C.O.E.
3	12/29/44	N26-1547	G.E.	Defective cover gasket. Dirt in relay C.O.E.
4	1/3/46	N26-1525	G.E.	Adjusted Target W.O.F.
5	7/8/47	N26-1542	G.E.	" Pick up W.O.F.

SET OF TEMPLATES for definite minimum time, standard energy, non-geared relays

PROTECTION

Against Transformer Burnouts

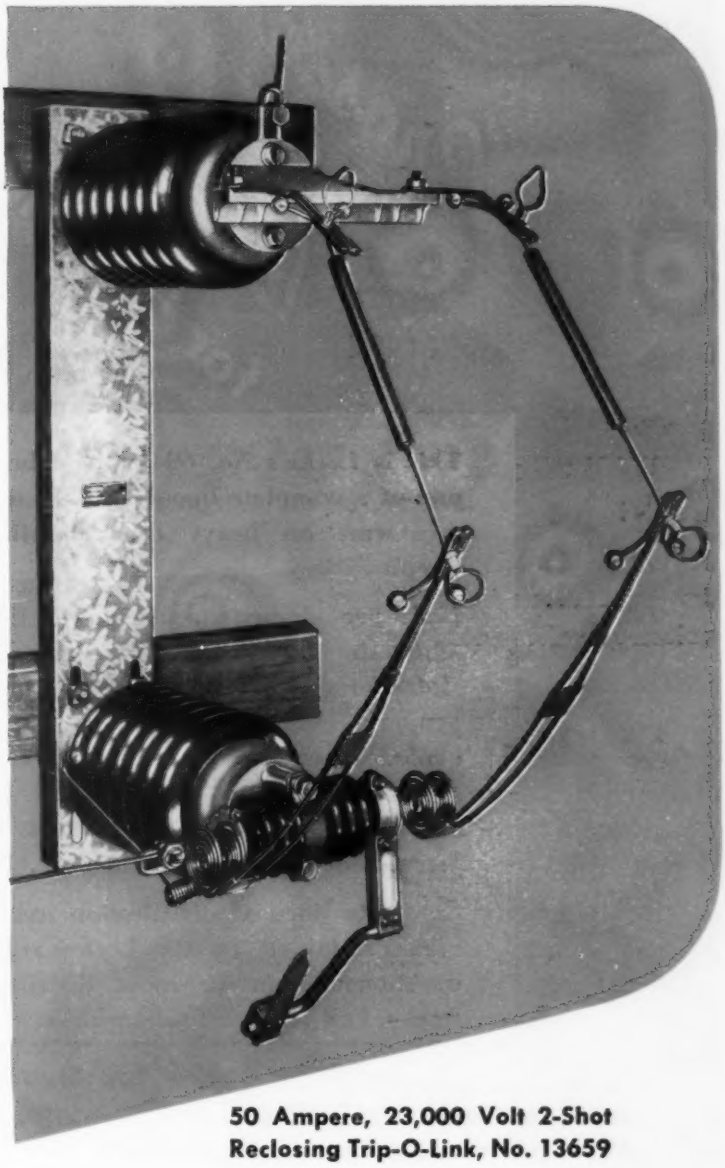
Kearney Trip-O-Link Fuse Cutouts, properly fused and installed, are your best guarantee that transformers are adequately protected. The operation is positive regardless of weather conditions.

Trip-O-Link action is never affected by ice nor snow, because the separating action of the lower contact arm will break any normal ice load.

The Trip-O-Link is an unique original Kearney design that is extremely simple and positive in operation. The combined fuse link and cartridge is kept under constant tension — so that it immediately separates into two parts when a fault occurs. A wide air gap between the two contacts eliminates any possibility of current leakage.

You can protect a $200.00 transformer for years to come by investing about $7.00 in a Kearney Trip-O-Link.

They are available in 50 and 100 ampere sizes, single-shot and two-shot reclosing types.



50 Ampere, 23,000 Volt 2-Shot Reclosing Trip-O-Link, No. 13659

For Better Results

Specify Kearney Products

JAMES R. KEARNEY CORPORATION

OVERHEAD AND UNDERGROUND UTILITY EQUIPMENT

4224-42 Clayton Ave., Saint Louis 10, Mo. • Canadian Plant, Leaside, Ontario

Look to Locke for Distribution Materials...

This is Locke's No. 6942 angle brace—one of a complete line—used to support crossarms on heavy duty distribution circuits.

Ends are aligned accurately to lie flat along the under side of the cross arm. Holes for attachment to the cross arm are properly sized and spaced to fit predrilled arms. And, of course, *Permazinc* — Locke's *Quality Controlled* double hot-dip galvanizing — adds extra years of dependable performance.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Call in your Locke representative.

Depend on Locke for Quality Controlled distribution materials ... pole line hardware and insulators. One order covers both.

Locke POLE LINE HARDWARE and INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

scratched upon the plastic template.)

3. The operating curve was traced several times. The template for each successive half time-lever was scratched to break off at a slightly higher point along the left-hand ordinate.

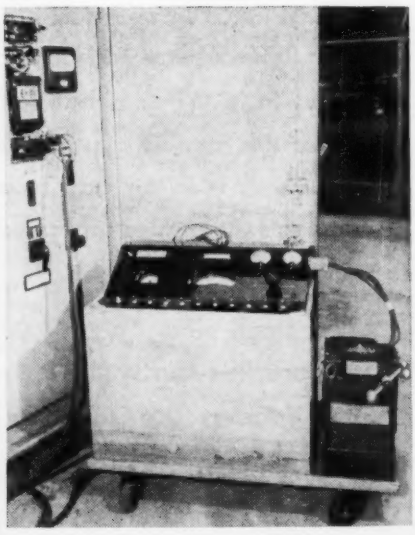
4. Sharp bending of the plastic developed breaks as desired. Burrs were removed with a fine, half-round file. Ink was rubbed into the lettering.

Having so many templates for each sort of inverse time limit relay on the system was not inconvenient.

Setting a relay to a curve is faster than setting it to a tabulation since no time is lost in adjusting current to exact values. With the relays set to prescribed curves, the selectivity experienced has improved greatly. This is in spite of reduced allowances for saturation effects, circuit breaker time and relay tolerances.

•

Portable Meter and Relay Test Set



METER AND RELAY SET for testing, calibrating and timing various devices that require variable current and voltage. Induction regulator (extreme right) supplies power from 120 or 240-v source

GEORGE W. PARKER
Public Works Dept
US Naval Air Station
San Diego, Calif.

DESIRABILITY of a portable relay and meter test set led personnel of the Public Works Department of the U.S. Naval Air Station, San Diego, to construct the compact and convenient set illustrated.

It consists of cabinet with instru-

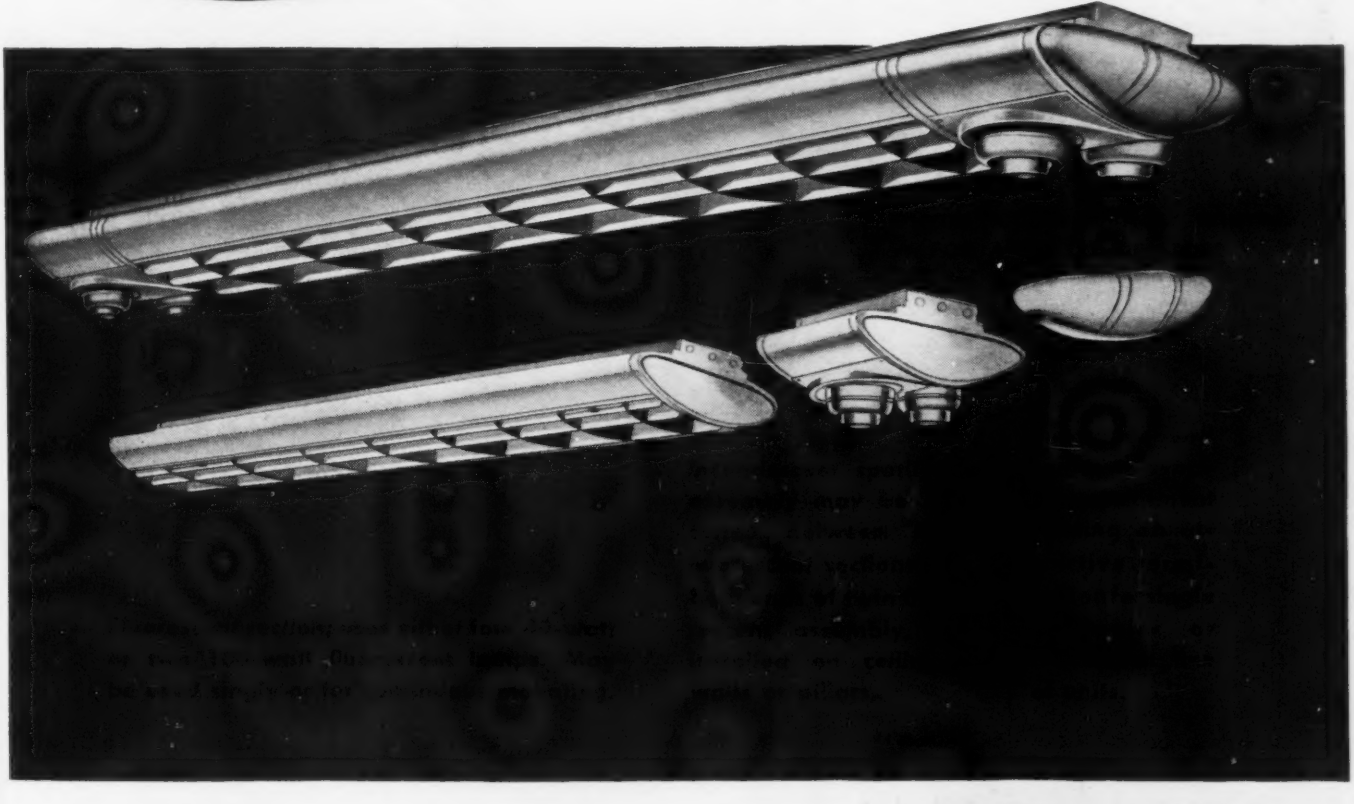
A new achievement in *Planned* store lighting

. . . the Westinghouse *Merchandiser*

Now, in one attractive luminaire, you have the basis for a complete, modern, planned lighting system for any type of store.

The MERCHANDISER combines the best qualities of fluorescent for general illumination with incandescent for highlighting of featured merchandise. Through various combinations of fluorescent sections, spotlight elements and decorative end caps, you can obtain a wide variety of planned lighting effects in sales areas.

Get all the facts on the MERCHANDISER before planning store modernization or new construction jobs. Ask your nearest Westinghouse office or distributor for a copy of Folder B-3788. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-04107



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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PLANNED LIGHTING

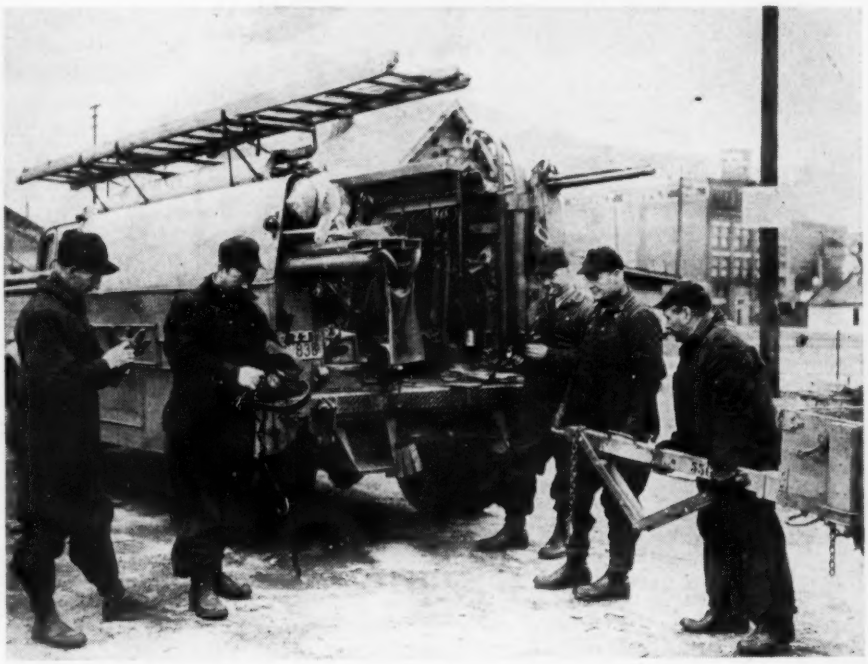
AVAILABLE THROUGH 127 WESTINGHOUSE ELECTRIC SUPPLY OFFICES AND INDEPENDENT DISTRIBUTORS

STOP
UNNECESSARY
FUSE
BLOWING
INSTALL
PIERCE
Balanced Lag
RENEWABLE FUSES
Exclusive Features, developed by Pierce engineers, dissipate heat by:
1. Link Design
2. Screen Ventilation
Typical High overload surge
200% Fuse load
135% Fuse load
100% Fuse load
TIME
NOTE: The elapsed time at 200% fuse load is a few seconds but at 135% load may be many minutes.
Pierce Balanced Lag fuses concentrate additional lag in the safe overload range, from 100% to 200% load, where lag is needed to prevent unnecessary fuse blows.
FREE: Balanced Lag Link to inspect and test. Specify amperage, voltage.
PIERCE
RENEWABLE
FUSES,
INC.
143
PACIFIC
AVE.
BUFFALO 7
N.Y.

ment panel which can be mounted on a dolly as shown. A small voltmeter and ammeter are provided to check the power source, either 120 or 240 v, a-c. Variable voltage and current are supplied by a dry-type, hand-operated, induction voltage regulator. Load current is measured by an ammeter and selector switch with seven ranges from 2 to 200 amp. The synchronous timer is calibrated in hundredths of a second. It can be used for open or close tests on relays. A 10-v bell-ringing transformer with buzzer provides for continuity tests.

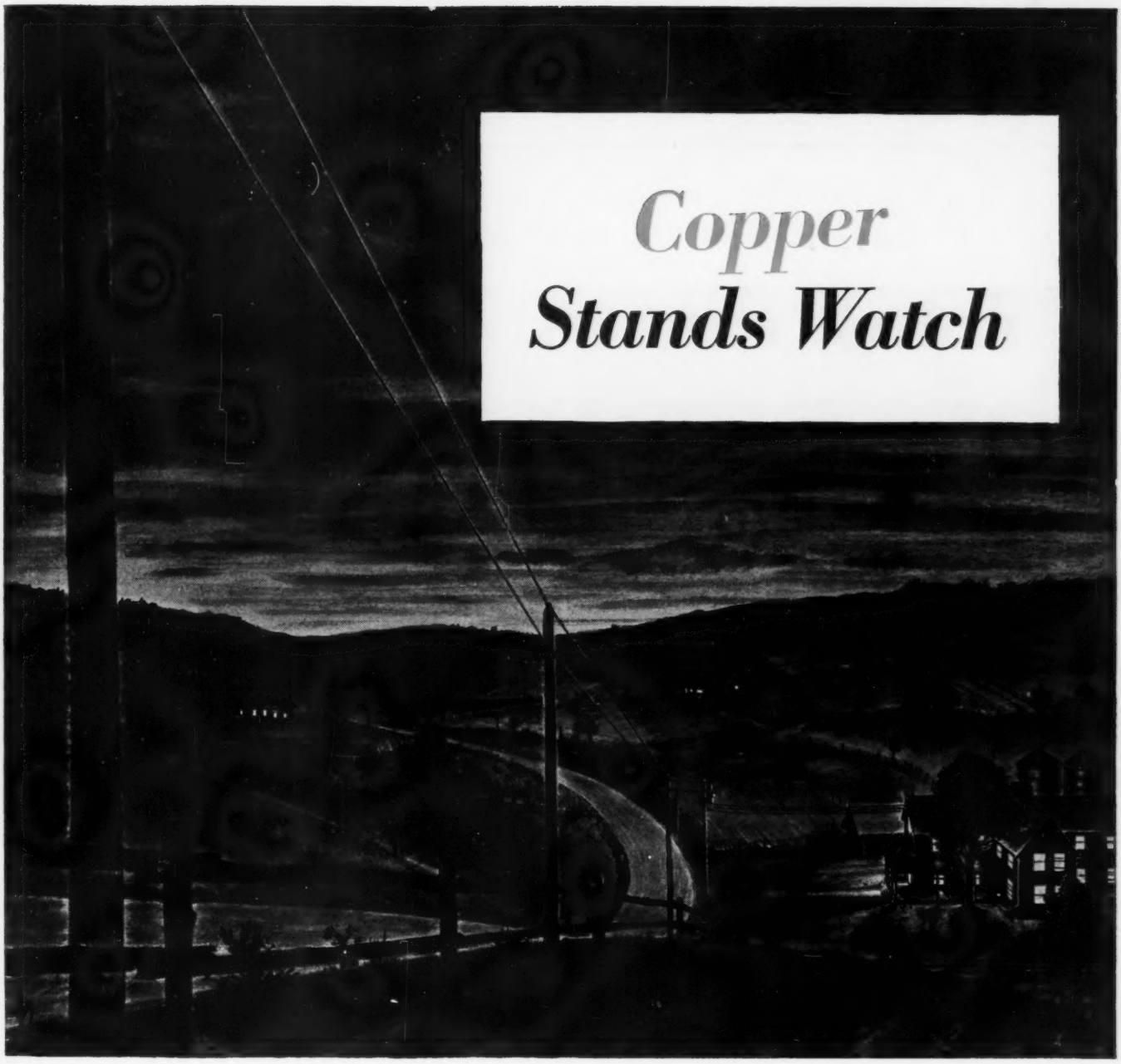
In testing a wide variety of electric meters and relays, this test set is not only versatile, but has shown improved accuracy and efficiency over old methods.

Safe Tools Cut Accidents



SAFETY EQUIPMENT and tools are given a complete check as the first step in a safe day's work, in the operations of line crews of the Wisconsin Public Service Corp., Milwaukee, Wis. This is standard procedure with this utility.

RUGGED AND POWERFUL, this four-wheel drive Dodge "Power Wagon" is one of 35 which Southern California Edison has in the field for tough assignments. This one-ton unit, operated by a three-man crew, provides ample tool and hardware space. A power-driven winch and guyed stiff-leg mounted on the front is used to erect poles up to 35 ft long



TONIGHT, in rural areas all over the country, many thousands of miles of Anaconda Copper lines are bringing light and power to farms and homes.

Power flows best through copper . . . and copper won't rust—meaning long, trouble-free service.

Insure against line failures. Specify copper through your local Anaconda distributor.

Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York.

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BARE COPPER WIRE AND CABLE
COPPERWELD-COPPER COMPOSITE CONDUCTORS
WEATHERPROOF SERVICES

LOOK TO *Anaconda* FOR CONDUCTORS THAT LAST! ANACONDA

LOAD BUILDING

Seven Times the Light after Seven Years

LIGHT INTENSITY is 7 times as much and load is 7 times as big as they were 7 years ago when fluorescent lighting was first installed (left) in this insurance company general office

STRIKING EVIDENCE of the speed at which ideas of fluorescent lighting applications are expanding appears in the relighting of three general office floors of the Mutual Benefit Life Insurance Co building at Newark, N. J. About seven years ago these offices were equipped with the then new fluorescent lights. The installation was considered outstanding at that time. How far and how fast the art has moved is shown by seven-fold increases in the following comparisons between the old and new office lighting installations of this company:

	Old Installation	New Installation
Average intensity at desk level	8 ft-c	60 ft-c
Number of fixtures per floor	190	501
Lamps per fixture	3 20-w	4 40-w
Lighting load per floor	14.25 kw	100.2 kw
Watts per sq ft	0.56	4

The new installation was designed by Charles Brady of Sylvania Electric Products Co, and H. C. Pennicke, efficiency consultant for the insurance company. According to Mr Pennicke, the windows at the sides of the room formerly had a psychological attraction that caused employees to move their desks towards them. This resulted in crowding and inefficient operations. With the new lighting, the 150 employes on each floor are content to work where their desks are placed, whether in the center of the room or at the sides.

All new wiring was required. This work was done by the Beach Electric Co, Newark. It included replacement of fused panel boards with breaker control. Area of each floor that was rewired is 25,000 sq ft.

• • •

High Kilowatthour Content for Frozen Foods

THE ELECTRICAL INDUSTRY has a larger stake in the quick-frozen food industry than it has probably realized. A survey made by ELECTRICAL WORLD on the West Coast indicates that every pound of quick-frozen food has an energy content of one-third of a kilowatthour for refrigeration only by the time it reaches the dinner table. This figure is on the conservative side and applies whether the frozen food reached the table via the locker plant or through commercial channels of distribution. It is predicated on the assumption that the average pound of quick-frozen food is held cold for a period of six months. Energy requirements of quick freezing at 35 deg below zero, storage at around zero in commercial warehouses, holding in the grocer's cabinet, and finally in the consumer's home freezer, all are included.

Volume of quick-frozen foods in the three West Coast states of Washington, Oregon and California was estimated at 600,000,000 lb in 1946. This includes fruits, vegetables and fish, but not meats or poultry. By 1950, it is estimated volume for all frozen foods will reach 1½ billion lb.

Quick-frozen viscerated poultry is receiving public acceptance and plants are springing up rapidly. The surface has hardly been scratched with quick-frozen meats. They are claimed

ON LINE CONSTRUCTION AND MAINTENANCE

FWD TRUCKS DO MORE WORK

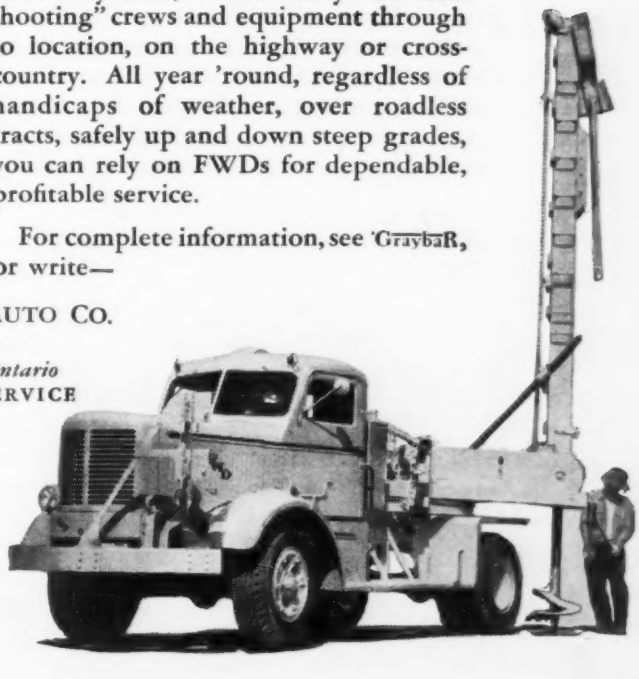
FWD four-wheel-drive utility trucks are more than mere trucks. They are highly specialized mobile "workshops" essential to line construction and maintenance. From bumper to bumper, they are utility-engineered "tools" for utilities.

The ruggedness and "going power" of FWD four-wheel-drive *power and traction on all wheels* have won for FWDs their reputation as "the trucks that *do not fail* the power lines that *must not fail.*"

Even when winter throws its snow blockades across field and highway, with ice and snow working havoc on communication systems, FWDs carry "trouble-shooting" crews and equipment through to location, on the highway or cross-country. All year 'round, regardless of handicaps of weather, over roadless tracts, safely up and down steep grades, you can rely on FWDs for dependable, profitable service.

For complete information, see GraybaR, or write—

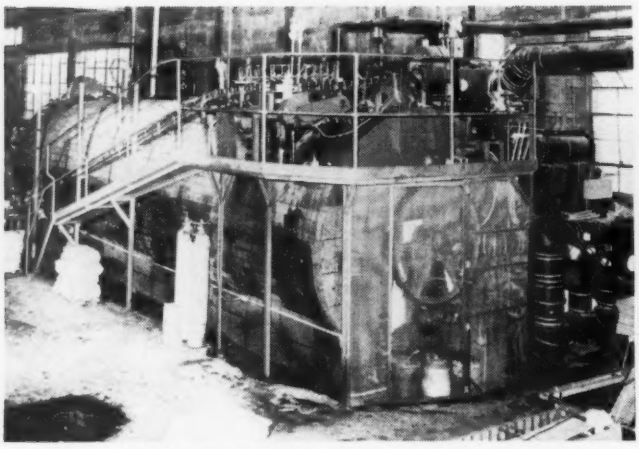
THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: Kitchener, Ontario
WORLD-WIDE SALES and SERVICE



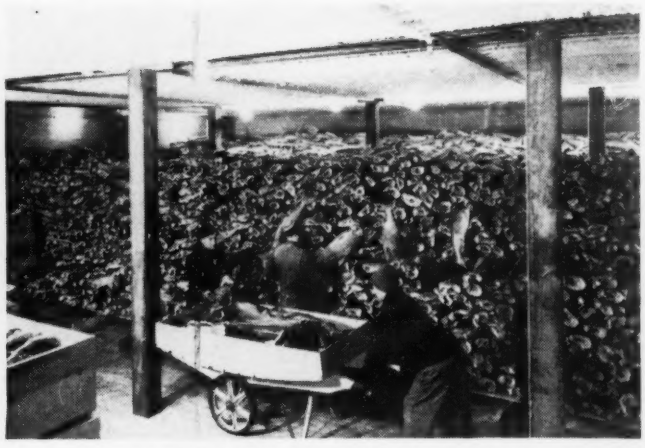
FWD

Distributed by GraybaR

America's Foremost Heavy-Duty Truck



ROTARY QUICK FREEZER—Latest development in quick frozen foods (left) is this rotary alcohol freezer that freezes melon balls in cans at 35 deg. below zero in a continuous process . . . Tons of frozen salmon stacked like cordwood (right) in plant of Columbia River Packers' Assn. at Astoria, Ore. These are typical examples of the current and widespread use of frozen food equipment



to be more tender than fresh meats.

Quick-freezing of fruits in cans is now a commercial process, although there are only a very few plants with equipment. One of these is the Dainty Mix brand plant at Modesto, Calif. The rotary continuous process alcohol freezer in this plant is shown. Such things as melon balls, grapes and fruits for salads were frozen in cans for the first time this year. Potentialities in this field are large.

All of this means that tonnage of frozen foods will increase tremendously. Requiring 666 kwhr per ton for refrigeration, the West Coast tonnage alone for 1946 required 200,000,000 kwhr—a sizable amount of energy. To produce this would require a 22,800-kw power plant operating continuously at 100 percent load factor.

The quick-frozen food industry means business for every branch of the electrical industry. With the figures here presented to show the industry's large stake in frozen foods, it is apparent that electrical men may well take a greater interest in this rapidly expanding industry.

Higher Mounting Reduces Vandalism

C. E. WALDRON, New York Power & Light Corp., Albany, N. Y.

THE HIGHER THEY ARE the harder it is to hit them. That's the principal reason why street lamps mounted at heights of 20 ft or more suffer less from breakage by vandals than do those closer to the ground. Contributing reasons are the heavier glass of modern luminaires and the deterrent effect of better lighting from them.

Some years ago two primary traffic streets in Albany were lighted by ornamental standards, 12 ft high. The average life of a globe was three years. For the 275 globes and canopies on these streets, the breakage averaged about 90 units per year. Since 1938, when pendant luminaires with heavier glassware were installed at 23-ft 6-in. mounting height, the breakage has been negligible. Experience to date indicates that the average life of these units will be well over ten years.

• • •

Long-Range Load Building via Schools

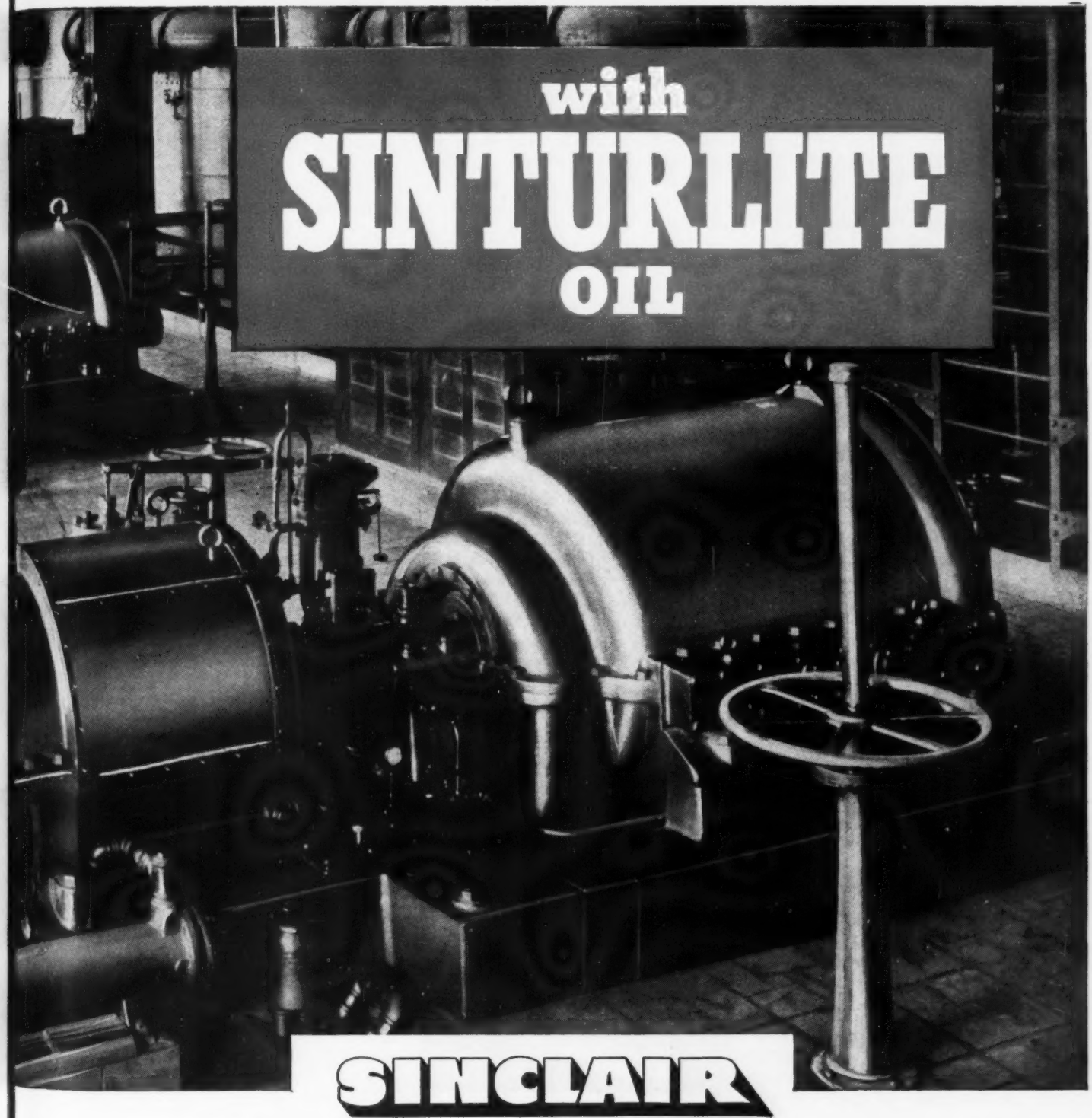
SETTING SIGHTS on distant horizons, the Electric Institute of Boston, Inc, took part in a recent vocational school conference. State Teachers College, Fitchburg, Mass., invited the Institute to send representatives to the conference for special emphasis on electrical work. The objective was to stress what the electrical industry expects from pupils in vocational and trade high schools and what they should learn to be better prepared.

The audience consisted of about 40 principals and teachers from these schools throughout the state. Their pupils ultimately enter the various electrical trades. Special courses extending through four days were given under Institute auspices. Two periods were scheduled each morning, one from 8:15 to 9:55 and the other from 10 to 11:45 o'clock. Lighting, refrigerator service, small appliance service and industrial electronics were the topics. Periods were conducted by specialists from manufacturing and sales organizations.

The following instructing personnel participated: C. M. Snyder, General Electric Co, Boston, "Store Lighting"; F. J. Vorlander, Champion Lamp Works, Lynn, Mass., "Industrial Lighting"; J. L. Steffenhagen, Westinghouse Electric Corp, Boston, "Office Lighting"; Willard Allphin, Sylvania Electric Products, Inc, Salem, Mass., "School Lighting"; Chas. Dauss and L. M. Caswell, Frigidaire Sales Corp, Boston, "Refrigerator Service".

Also J. P. Looney, General Electric Appliance Service, Boston, "Small Appliance Service"; and C. E. Burnett, Radio Corp of America, New York, "Industrial Electronics".

..and STAY RIGHT



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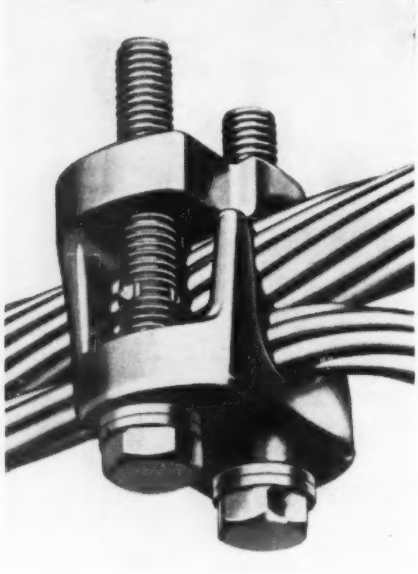
NEW EQUIPMENT

Two-Bolt Clamp



A NEW TWO-BOLT clamp for making pressurized taps has been announced by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo. This one-piece unit features double coil lock washers to combat tightening losses due to vibration. Castings of the clamp are high strength bronze, and the bolts are fabricated from Everdur.

The clamp is available for use with copper conductors from No. 4/0 to 1,000 M cir mils, and for aluminum cable in equivalent sizes. It can accommodate two maximum size cables, or one maximum size cable and one minimum size cable as low as No. 6 Awg.

•

Cathode-ray Oscillograph

IN THE TYPE 247A cathode-ray oscillograph, Allen B. DuMont Laboratories, Inc, Passaic, N. J., has developed a high-voltage instrument to exploit fully the capabilities of its circuits when used for the study of non-recurrent transients.

This new cathode-ray instrument is electrically identical to the well-known type 247 cathode-ray oscillograph with the exception that it utilizes the type 5RP-A, multiband, high-voltage, intensifier-type cathode-ray tube. Used with type 263-A 10-kv high-voltage power supply, the type 247-A provides a brilliant, sharp trace for the delineation of the finest detail of single transients. The guaranteed photographic writing rate of the type 247-A, using an object-image ratio of 5:1 and an f/2.0 lens is 100 km per sec or 4 in. per microsecond with a type 5RP11-A cathode-ray tube.

Through use of the Du Mont type 2088 projection lens, the type 247-A instrument, used with the type 263-A high voltage power supply, becomes a projection oscillograph which gives large-screen patterns suitable for use in a darkened auditorium.

•

Fork Truck

A 1,000-LB CENTER-CONTROL fork truck designated type FQH-10 is made available by Baker Industrial Truck Division of Baker-Raulang Co, 2168 West 25th St, Cleveland 13, Ohio. The truck is 28 in. wide, has a 36-in. wheelbase, and overall length, exclusive of forks, of 54⅝ in. Its weight is 3,800 lb with load. A right-angle turn is said to be made in only 67½ in. plus the length (30 in.) of the load. A seat is provided for the driver.

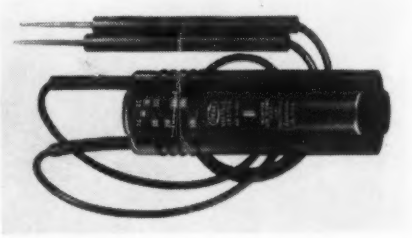
Battery is stated to have a capacity of 6.7 kwhr and to be ample for 12 hours of work. The motor-generator type charger is automatic; starts when

power is supplied and shuts down when battery is fully charged. In case of power failure the equipment disconnects and restarts when service is restored.

This short and narrow truck has a travel controller providing three speeds forward and reverse. A contactor makes and breaks the circuit. Motor is disconnected from power supply when the driver removes his foot from the treadle to apply the brake.

•

Voltage Tester



FOR USE ON circuits up to 550-v a-c and 600-v d-c, a new voltage tester has been announced by Ideal Industries, Inc, 1021 Park Ave, Sycamore, Ill. Indications are by a solenoid indicator and a neon test lamp, both in the same case.

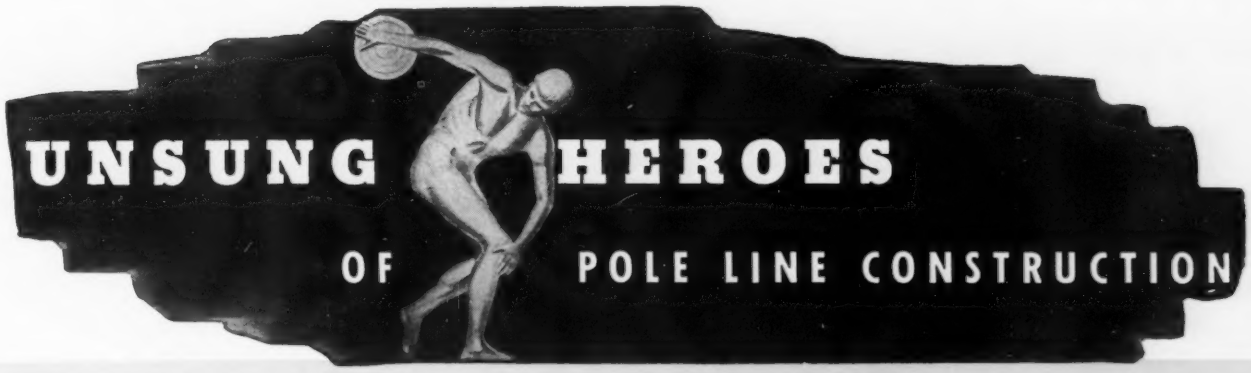
The plastic case is 6 in. long and has a scale calibrated from 110 to 600 v. Leads are 2 ft long and extend from top of case. Test prods are 2 in. long and prod handles are 4 in. long. Weight is 8 oz.

•

Capacitance Bridge

A CAPACITANCE BRIDGE suitable for measurement of capacitance in multi-electrode systems has been announced by the Electronics Division, Sylvania Electric Products Inc, 500 Fifth Ave, New York 18, N. Y. The instrument, particularly useful in measuring inter-electrode capacitances in vacuum tubes, provides a range of 0 to 100 $\mu\mu$ through the use of five multipliers and measurement at 465 kc. Director capacitance accuracy of 1 percent and direct conductance accuracy of 10 percent are provided when calibrated with standards of commensurate accuracy.

The bridge consists of three separate sections including r-f signal generator and power supply; r-f amplifier, detector and vacuum tube voltmeter; and associated switches, controls and 500-microampere meter indicating bridge balance. Ground to lead or jig capacitance may be tuned out when combined



Simple things, CROSS ARM BRACES, just a strip of flat steel with a hole punched in each end, but most important to a pole line. Hubbard Braces are fabricated from the best, new, open-hearth steel and all corners are rounded to protect linemen from sharp projections. For the engineer who wishes additional strength on the compression side of the arm, the ribbed brace is provided and offers approximately 25% added protection.

HUBBARD FLAT AND RIBBED CROSS ARM BRACES

HUBBARD ANGLE CROSS ARM BRACES, for heavy construction, are supplied in a range of spreads and drops to meet the requirements of any standard construction. Angle size runs from 1½ to 2-inches. At the pole attachment hole, the angle is so formed that wrench clearance is provided. Attachment is by ⅝-inch Machine Bolt at the pole and ½-inch Carriage Bolts at the arm.

HUBBARD ANGLE CROSS ARM BRACE

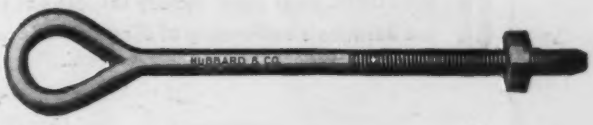
DRIVE POINT MACHINE OR CROSS ARM BOLTS are roll-threaded to provide a "finger-fit" for the full length of the thread. The "Drive Point" feature enables the bolt to be used as a drift pin for the alignment of holes slightly off center. This operation must be carried out with caution so as not to injure the threads. "Drive Point" also facilitates the application of nuts and allows bolts to be driven out of the pole for reclamation without injury to the threaded end. The major portion of Hubbard bolts of all types have this feature.

HUBBARD DRIVE-POINT CROSS ARM OR MACHINE BOLT

HUBEYE BOLTS are furnished for attachments of any kind where a thimble would normally be used. The eye of the bolt is drop-forged to a shape which provides a perfect "built in" thimble. Strand may be looped around the Hubeye with complete protection. Side walls of the eye retain the roundness of the strand. There is no possibility of kinks or strains at the loop. Hubeyes are a thoroughly tried and proven product.

HUBEYE DRIVE-POINT BOLT

STANDARD HUBBARD OVAL-EYE BOLTS are an old line item still much used in many sections. Hubbard Eye Bolts are all drop-forged with an eye that is stronger than the shaft of the bolt. Made from the best, new, open-hearth steel and Hubbard Double-Dip Hot Galvanized.



HUBBARD OVAL-EYE DRIVE-POINT BOLT

HUBBARD AND COMPANY

PITTSBURGH
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2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

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WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

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BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

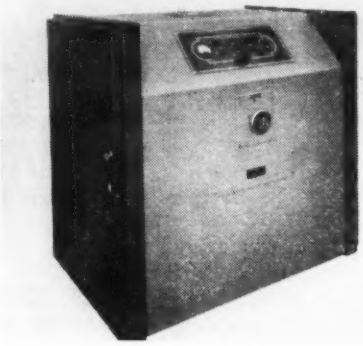
values do not exceed 25 $\mu\mu$.

Type 125 capacitance bridge is rated at 45 W, 110-120 v, 50-60 cycle; weighs 50 lb; and measures 19 in. long and 12¼ in. high. Tube complement includes 5Y3G, 7A6, 0C3 and two 7A7. Rated capacitance ranges in micromicrofarads are: 0-0.01; 0-0.1; 0-1; 0-10; and 0-100.

•

H-F Generator

A NEW 10-kw high frequency generator, adaptable to either batch or continuous edge-gluing presses, has been designed by Westinghouse Electric Corp, East Pittsburgh, Pa. Called the "Woodworking" generator the new unit features push-button operation in the production of open face panels and core stock or in assembly gluing, laminating, bonding, or molding.



The generator is designed to produce its full rated output with all its tubes operated conservatively and is certified to meet FCC requirements when properly installed and operated. It is available in 5 and 13.6 mega-cycle units that operate from a power circuit of 230/460 v, three-phase, 60 cycles.

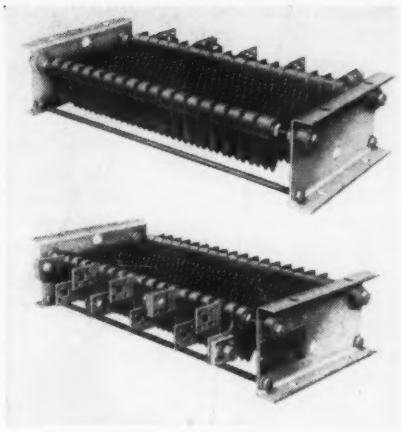
•

Tab-Weld Plate Resistors

FOR USE in electric motor controller and starter duty, The Electric Controller & Mfg Co, 2700 East 79th St, Cleveland 4, Ohio, announce a new line of non-breakable resistor sections. The resistor-ends are off set and spot-welded together to form a continuous path throughout the section. Terminal-plates for external connections are also welded in place.

Known as Tab-Weld plate resistors, the individual resistors are stamped in the form of grids from flat-rolled, corrosion-resistant, chromium alloy steel. This material has a negligible resistance-change between cold and maximum temperatures. Moulded insulating spacers, which will not soften below 2,000 F, are used between the separated ends.

Each resistor has a tab at each end



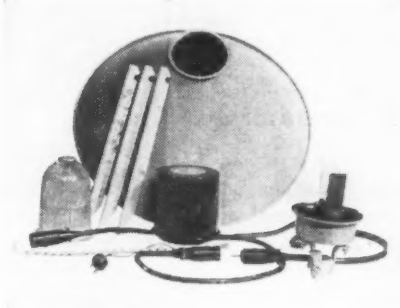
and terminal-plates. The latter have tabs to match with the resistor-tabs.

Terminal clamp-blocks have grooves to accommodate several sizes of wire. They are bolted to the terminal-plates and are movable from plate to plate to provide the desired resistance between steps. Flat bus for external connections may be bolted on by the four holes in each terminal-plate.

Mounting dimensions are maintained regardless of the grid-stack length. Sections are available in several capacities and are of the same width, length and height. Mill sections are built with the same size resistors per section.

•

Airport Lighting

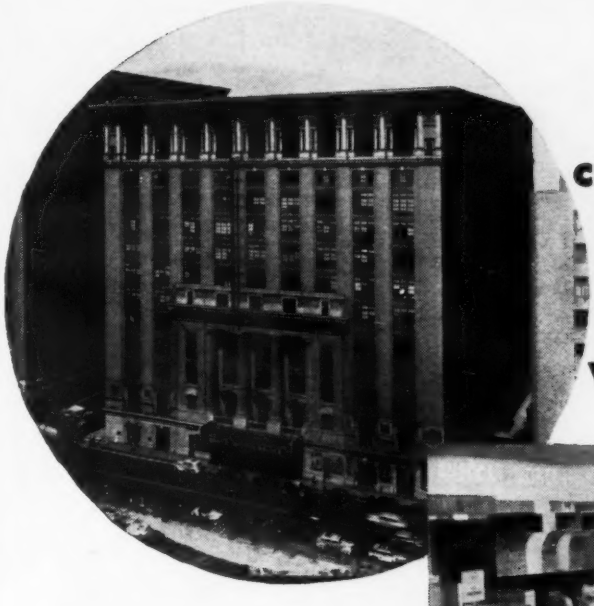


AN AIRPORT LIGHTING PACKAGE built to CAA specifications has been jointly announced by American Gas Accumulator Co, Elizabeth, N. J., and the Lighting Division of General Electric Co, Schenectady, N. Y. It is said to contain all the components necessary for lighting runways from 1,800 to 7.000 ft.

The system is stated to be easy to install because every connection from the power receptacle through to the lamps is plugged in through the use of waterproof rubber plugs. Cable need only be buried in shallow trenches.

Included in the kit are: Type IL insulating transformers for burial in the ground; Versatol-geoprene cable for circuits up to 600 v and cut to required lengths; control cabinet with constant-current regulator, runway brightness and selector controls, and protector relays; elevated runway markers, and threshold, taxiway and obstruction

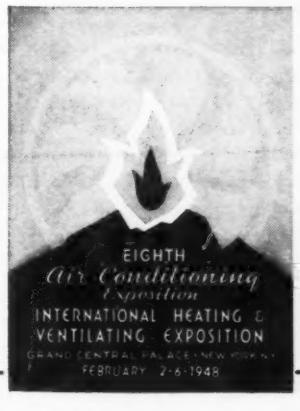
A Palace-ful of Profitable IDEAS ...on AIR CONDITIONING HEATING AND VENTILATING



Every available square foot of display space on 4 floors in spacious Grand Central Palace, New York City, will be teeming—from February 2 to 6—with arresting, idea-stimulating exhibits of the latest equipment being offered for supplying conditioned air, heat and ventilation to all types of public, commercial and industrial buildings. Every one of the more than 350 exhibitors will afford you a multiplicity of opportunities to supplement your fund of working knowledge . . . by studying and comparing newest developments . . . learning latest trends and practices . . . talking over your interests with engineering specialists on hand to give you practical ideas and suggestions on current problems and future plans.

In no other place can anyone interested in selling or applying air conditioning, heating or ventilating for industrial and commercial applications—get so much valuable information, vital new ideas for an expenditure of so little time.

Be sure to attend—remember the dates.



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SUPERIOR SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO
A subsidiary of the Union Metal Manufacturing Co.

lights. The lights use 30 to 45-, 6.6-amp, standard runway lighting lamps, housed in prismatic lenses and reported to provide more than 1,000 candlepower.

Lights are mounted on lightweight cones secured to ground above the insulating transformers by a staking method. The lamp circuit is plugged into the insulating transformer secondary lead.

•

Humidity Indicator

A QUICK-READING all-metal humidity indicator, designed for use in industry and laboratory, has been announced by the Weston Electrical Instrument

Corp, Newark, N.J. The indicator is stated to provide readings of relative humidity accurate within plus or minus 1 percent for general conditions.

The instrument is a wet and dry bulb type, featuring all-metal Weston laboratory thermometers, self-supporting wet-bulb wick covering the thermal element, and a simplified slide rule calculator. The slide rule indicates directly the relative humidity from 10 to 100 percent.

•

1-Inch Instruments

PRECISION instruments with D'Arsonval movement and mounting in a 1-in. opening are made available by International Instruments, Inc, New Haven, Conn. The midget units are obtainable in six basic ranges: 0-100, 0-200 and 0-500 microamperes, 0-1, 0-5 and 0-10 milliamperes. Shunted ammeters, a-c and d-c voltmeters can be furnished self-contained in a slightly larger series.

•

Germicidal Lamps

TWO TYPES of germicidal units have been announced by Duro Test Corp, North Bergen, N. J. One unit is designed to kill airborne bacteria through indirect radiation; the other, to destroy molds, bacteria virus and fungus through direct radiation, on surfaces and in liquids. The germicidal lamps used in the units are produced in two sizes: 15-w. 18-in. length, and 30-w, 36-in. length.

Typical examples of the lamp's total kill at 1 ft are said to be: Common molds, 3 min; common bacteria, 8 sec; black molds, 7 min.

A 30-w lamp is reported to provide 99 percent air purification for an area of 125 sq ft in a room with an 8-ft ceiling, 150 sq ft with a 10- to 12-ft ceiling or 190 sq ft for a space with a 16-ft ceiling.

•

Motor Capacitors

A NEW LINE of bracket-mounted, armored, space-saving, motor-starting capacitors, Series SRVC, is announced by Aerovox Corp, New Bedford, Mass. These capacitors are stated to be fully protected against mechanical damage, dirt and the usual climatic hazards, and are distinguished by compactness. The steel casing measures only 2$\frac{7}{16}$ in. in diameter by 2$\frac{7}{8}$ in. to 3$\frac{3}{4}$ in. long depending on voltage and capacitance ratings. Standard ratings are 110, 220, 330, 440 and 660 v, a-c, while capacitances range from 1 to 8.5 mfd. The flexible pigtail leads from the encased capacitor are brought out through an insulated hole in the cap. Two screw-holes are used for mounting.

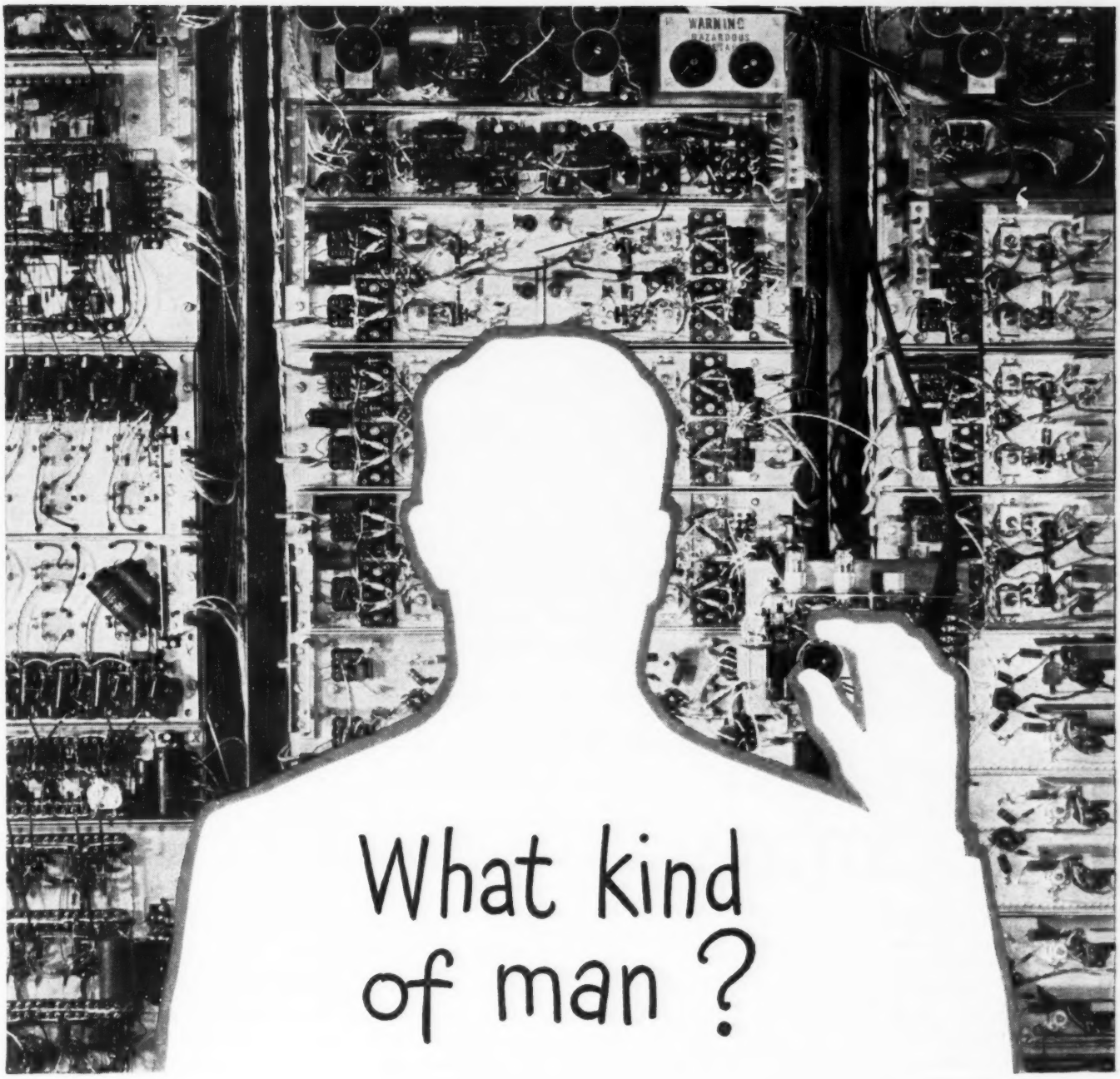
•

Programming Control

TO PROVIDE AUTOMATIC starting and programming control for commercial and industrial oil burning equipment, the type 24 PJ 8 control was designed by Combustion Control Corp, 77 Broadway, Cambridge 42, Mass. It is used with a scanner to protect the installa-

tion from the hazard of flame failure.

Timing cams are driven by a synchronous motor. Fuel valve delay and post-ignition periods can be set on installation. A dial indicates the timing adjustment. The unit has a load rating of 1 hp, 115/230 v, 60 cycles.



What kind of man?

WHAT KIND of men are the 2,300 scientists and engineers of Bell Telephone Laboratories?

Men of many types, working in different fields of research, may contribute to each development.

But all have certain characteristics in common: Good minds as a foundation, many years of learning in the fundamentals of their science and the methods of research, and a co-operative attitude — for without co-operation of individuals these products of research could never be produced.

Above all else, however, they have "the spirit to adventure, the wit to question, and the wisdom to accept and use."

That kind of men can produce the finest telephone equipment in the world — and have done so.

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VARNISHED TUBING PRODUCTS

flexibility!

Put your electrical products together *faster* with this varnished tubing that's easy to handle in close quarters . . . easy to push around corners . . . easy to thread because it stays round and has a smooth inside bore.

Dieflex varnished tubing and sleeving has repeatedly shown its ability to cut assembly time and lower costs. High dielectric strength and clean-cut, non-fraying ends are plus values that make it acceptable for the most critical applications.

Dieflex tubings and sleevings are made in all VTA and ASTM grades. Shipment from stock. Call your nearest representative for detailed information.

DIEFLEX PRODUCTS LIST

MADE WITH BRAIDED COTTON SLEEVING BASE—VTA Grade A-1 Magneto Grade Varnished Tubings—VTA Grade B-1 Standard Grade Varnished Tubings—VTA Grades C-1 and C-2 Heavily Coated Saturated Sleevings—VTA Grade C-3 Lightly Coated Saturated Sleevings—Heavy Wall Varnished Tubings and Saturated Sleevings.

MADE WITH BRAIDED GLASS SLEEVING BASE—VTA Grade A-1 Magneto Grade Varnished Fiberglas Tubings—VTA Grade C-1 Extra Heavily Saturated Fiberglas Sleevings—VTA Grade C-2 Heavily Saturated Fiberglas Sleevings—VTA Grade C-3 Lightly Saturated Fiberglas Sleevings—Silicone-Treated Fiberglas Varnished Tubings and Sleevings.

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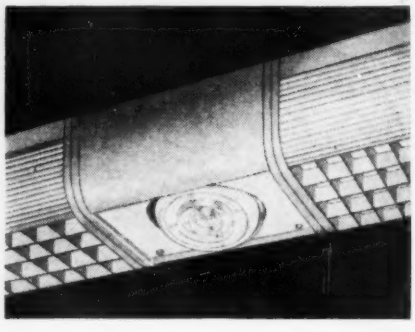
DAYTON 2, 1315 Mutual Home Building
DETROIT 2, 11341 Woodward Ave.

REPRESENTATIVES in MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court.

Downlight Fixture

To PROVIDE concentrated light such as for spot displays, bulletins, maps and show cases, the "Dramatizer" has been



developed. It is a product of Pittsburgh Reflector Co, Oliver Bldg, Pittsburgh 22, Pa.

Surface mounted individually or in line with fluorescent troffers, this Series A-178 Downlight may be adjusted to swing in a circle up to 35 deg. from its vertical axis. Type PAR-38, 150-w incandescent lamp with side-prong base is used. Integral concentric louvers shield the light source.

MORE NEW PRODUCTS
about which you should know

Allen B. DuMont Laboratories, Inc, Clifton, N. J., has developed a type 271-A oscillograph-record 35 mm **camera** for 5 in. oscillographs. . . . Simpson Electric Co, Chicago, Ill., announced a model 445 tube and set **tester** with mechanism which returns all switches to normal automatically at end of each test. . . . Remington Rand, Inc, New York, N. Y. has an **electronic tube,** Magic Remtron, that is applicable in calculating mathematical **problems.**

George Scherr Co, New York 12, N. Y. presents a new Wilder **optical comparator** for performance of assembly operations on minute parts. . . . Metron Instrument Co, Denver 9, Colo., has available electric hand **tachometers** for three separate speed ranges up to 10,000 rpm on a 100-division, 3⅛-in. scale. . . .

Harnischfeger Corp, Milwaukee 14, Wis., offers a model WN 200-amp portable **arc welder** that can provide 1½ kw, 115-v, single phase service. . . . Paper Machinery and Research, Inc, Roselle, N. J., has developed two de-reeling **tensions** for faster coil winding, handling wires 44 to 38 and 40 to 20 AWG. . . . Jenn Air Products Co, Indianapolis, Ind., is producing a 980 cfm **exhauster** constructed of aluminum with the motor outside the air stream.

Solar Manufacturing Co, North Bergen, N. J., has available radio interference **filters,** type EB for noise elimination range from 150 kc to 250 mc. . . . Coffing Hoist Co, Danville, Ill., introduced a **hoist-jack** with a capacity of 2000 lb; a hoist unit mounted on a stand doubles as a jack for lifting and pulling jobs. . . . Plomb Tool Co, Los Angeles 54, Calif., announced a **tool set** —a leather kit containing a 6-in. slip-joint plier, a 6-in. adjustable angle wrench and an 8-in. plastic handle screwdriver with 9/32-in. bit.

Rubicon Co, Philadelphia 32, Pa., has a new series of direct-reading temperature-calibrated portable **potentiometers** for use with copper-constantan, iron-constantan or chromal-alumen thermocouples. . . . New York Transformer Co, Alpha, N. J., has introduced a line of fluorescent **lamp ballast** units, available in 30 types. . . . Condenser Products Co, Chicago 22, Ill. announced a line of hermetically sealed high voltage-low current d-c **power supply** units, transforming 118 v, 60 cycles to 2400 v d-c.

Western Lithograph Co, Los Angeles 54, Calif., has E-Z-Code numbered **markers** to wrap on wire ends prior to pulling through conduit. . . . Arco Company, Cleveland 4, Ohio, has developed an elastic **coating material** known as "Dum Dum for Metal" for "weather-proofing" outdoor metal surfaces such as transformers and storage tanks. . . . American Molded Products Co, Chicago 22, Ill., is marketing black plastic **cable clamps** in ⅜, ½ and ⅝ in. sizes.

National Electric Products Corp, Pittsburgh 19, Pa., is marketing a **duct system,** includes 14 gage steel underfloor duct 1⅜ x 2⅞ in. in 10-ft. lengths and floor outlet with 1½ in. pipe thread. . . . Tweezer-Weld Corp, Newark, N. J., developed an automatic **welder** which also shapes small parts, also welds bimetal strip to a two-piece lead and forming and cutting the strip to length. . . . Bardon Manufacturing Co, Far Rockaway, N. Y., has a line of male **plugs** to fit Continental European and South American receptacles and wall plugs.

J. D. Whittle Co, Chicago 6, Ill., announces interchangeable electric hand **drill attachments** to saw, sand, drive screws, polish, grind and file. . . . American Chemical Paint Co, Ambler, Pa., has developed the Alodine **process** which is said to alter the chemical nature of aluminum surface and to impart corrosion resistance to the metal and a paint bond of adhesive qualities. . . . Mine Safety Appliances Co, Pittsburgh 8, Pa., has a carbon monoxide **tester** using a detector tube with chemicals which change color; degree of discoloration is compared on a revolving scale.

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Get New Clutch Service at 2/3 the Cost

AVAILABLE NOW FROM YOUR INTERNATIONAL DEALER OR BRANCH

INTERNATIONAL Factory-Rebuilt EXCHANGE CLUTCHES

Same International Warranty as for New Clutches

HERE'S your chance to immediately replace worn, slipping clutches—quickly, easily—and save one-third the cost of new clutches.

Right now your International Dealer or Branch has International *Factory-Rebuilt* Clutches for all models of International Trucks.

These clutches are ready for immediate installation. You lose no time waiting for old clutches to be overhauled.

You get International Clutches that give the same service as new clutches—that carry the same International warranty.

And the cost to you is two-thirds or less.

Act now! Avoid lay-ups and delays! Get better truck performance! Have your International Dealer or Branch install International Factory-Rebuilt Clutches now.

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NEWS ABOUT PEOPLE

Trumbull Electric Elects Fleming Vice-President

Announcement has been made of the election of William J. Fleming to the position of vice-president in charge of engineering of the Trumbull Electric Mfg. Co, Plainville, Conn.

Mr Fleming has been associated with

W. J. Fleming

the Trumbull company since early in 1946 and has been executive engineer of the company since April of this year. He was formerly connected with the control engineering division of General Electric Co, where he served as materials handling engineer, administrative assistant and finally as assistant engineer of the division.

He is active in the National Electrical Manufacturers Association and the AIEE.

•

► C. H. Stanton, Jr, has been appointed general manager of the Orlando (Fla) city utility system, succeeding the late Martin W. Brown. Before joining the Orlando commission last April, he was connected with the General Electric Co in Schenectady, N. Y.

► W. E. Hammond, who has been connected with the U. S. Maritime Commission since 1938, has joined the staff of the Air Preheater Corp, New York. Mr Hammond's headquarters will be at the Wellsville (N. Y.) plant. From 1942 he was chief of the engineering, scientific and electrical branch design division, of the Maritime Commission. Prior to joining the government agency he was with Gibbs & Cox, naval architects, for three years. A paper prepared by Mr Hammond, entitled "Discussion of Transmission Systems for Marine Propulsion Gas Turbine Power Plants," was read before the ASME meeting held recently in Atlantic City.

•

Young Relinquishes Duties With Public Service Corp.

Percy S. Young retired on Dec 19 as chairman of the executive committee of the Public Service Corp of New Jersey and its subsidiary companies, on his 77th birthday, after more than 49 years with Public Service and a predecessor company.

He was secretary and assistant treasurer of the Hudson County Gas Co, a predecessor company of Public Service, and when Public Service was formed in 1903 he was elected comptroller of the latter. He became treasurer and later was elected vice-president in charge of finance, Public Service, and in 1939 was elected chairman of the executive committee.

Long active in national public utility associations, Mr Young was a past-president of the American Gas Association, served as treasurer of the old National Electric Light Association and was active in its successor, the Edison Electric Institute.

•

► William M. Goss, vice-president of the Scovill Manufacturing Co, Waterbury, Conn., has been elected president of the Copper and Brass Research Association.

► Thomas B. Copeland has been appointed manager of Pacific Gas & Electric Co.'s Shasta division, with headquarters at Red Bluff, Calif., to succeed G. R. Milford. Mr. Copeland will retain his present duties as division superintendent along with the managership. Mr Milford retired after 44 years of service with PG&E, 27 years as division manager. Mr Copeland has been with PG&E and predecessor companies for 34 years.

Anderson Brass Appoints Howarth Sales Manager

Anderson Brass Works, Inc, Birmingham, Ala., has announced the appointment of J. L. Howarth as general sales manager.

A graduate electrical engineer, Mr

J. L. Howarth

Howarth started his career in the engineering department of the General Electric Co in 1924. He has been actively engaged in the electrical industry since that time. During the past several years, he has served as general sales manager of Roller-Smith, Bethlehem, Pa., and Electric Power Equipment Corp, Philadelphia, Pa.

•

► Robert H. Willard, former general counsel for the Bonneville Power Administration at Portland, Ore., has been appointed area counsel for the Atomic Energy Commission at Los Alamos, N.M. In his new position Mr Willard also will serve as assistant general counsel for the entire Atomic Energy Commission. Mr Willard was transferred from the legal staff of the land division of the Department of Justice at Washington to BPA in 1939, became Bonneville assistant counsel in 1941 and general counsel in 1946.

► J. J. Morrison has been made assistant to the president of the Gulf States Utilities Co. with offices in Beaumont, Tex. Mr Morrison has been connected with Stone & Webster and Engineers Public Service Co, former parent com-

Natvar insulating materials are prominently displayed in this Chinese Shipchandlery. According to the signs, they handle, in addition to electrical materials, "steamship machinery, agricultural machinery, rubber goods, hardware, mine and factory supplies, iron, steel and miscellaneous."

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- Varnished Fiberglas cloth
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- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing
- Extruded vinyl identification markers

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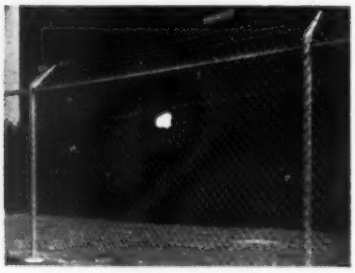

Stewart Style 3TH Chain Link Wire Fence as illustrated offers the utmost protection for all types of industrial property. This fence is also available in style 5TH which carries five strands of barbed wire. Other Stewart products for industrial use include: Iron Picket Fence and Entrance Gates; Wire Mesh Partitions; Wire and Iron Window Guards; Steel Folding and Sliding Gates; All Steel Settees; Flagpoles; Wire Trash Baskets, etc. When writing for literature please mention products in which you are especially interested.

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Stewart IRON and WIRE FENCES

pany of Gulf States, for a number of years For several years prior to the dissolution he was assistant to the vice-president of Engineers. As assistant to the president, Mr Morrison will serve as an analyst and help in handling the many corporate matters formerly taken care of by Engineers staff in New York.

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Rehm Made Chief Engineer for Springfield Boiler

Gustav A. Rehm, formerly identified with the Riley Stoker Corp, Worcester, Mass., has been made chief engineer for the Springfield Boiler Co, Springfield, Ill. In this capacity he heads all

G. A. Rehm

engineering activities in connection with steam generators and related equipment.

Mr Rehm is well known to the engineering profession for the prominent part he has had in boiler design and development since 1926, when he joined the Badenhausen Corp in Philadelphia prior to its consolidation with Riley Stoker Corp. He is a member of the ASME.

As chief engineer he succeeds W. Ross Irwin, who has recently engaged in a private engineering practice with headquarters in Springfield. Mr Irwin continues his association with the Springfield Boiler organization as a consultant.

•

►R. E. Uptegraff, Jr, sales manager for R. E. Uptegraff Manufacturing Co, Scottdale, Pa., has been given a Navy citation for his research and development in naval ordnance, particularly in torpedo proximity exploder mechanisms. Mr Uptegraff put in war service at Pacific Coast Naval Ordnance Activities. His five years' development work there also brought official commendation from the Office of Scientific Research and Development, and from the 13th Naval District.

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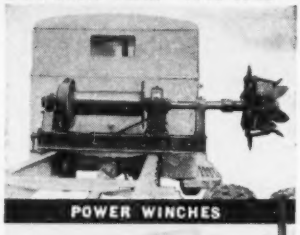
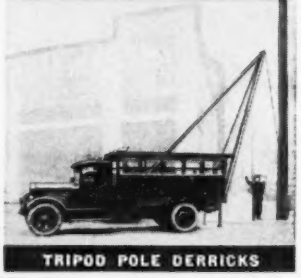
OUR 30TH YEAR—1918-1948



POWER WINCHES



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POLESETTING DERRICKS, TOWERS, CRANES, etc.
TYPICAL USERS: AT&T; N.Y.Tel. Co.; T.V.A.; Virginia P. S Co.; Consolidated Edison Co.; Ohio Power Co.; Texas Power & Light Corp., etc.
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2½, 5, AND 10 TON CAPACITIES
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FOR HEAVY INDUSTRIAL SERVICE
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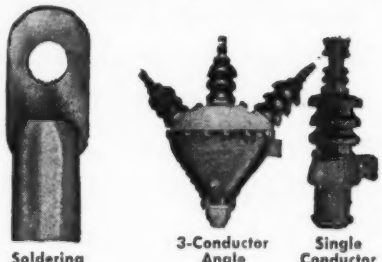

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Federal Electric Appoints Graves Vice-President

Announcement has been made of the appointment of Robert C. Graves as vice-president in charge of sales of the Federal Electric Products Co, Newark, N. J. Mr Graves brings to Federal more than 28 years of experience in the

R. C. GRAVES

electrical manufacturing industry. He was connected with the Trumbull Electric Manufacturing Co since his discharge from active duty as an ensign in the Navy at the close of World War I. In 1944, he became vice-president of the company in charge of sales.

For the past 15 years, Mr Graves has been actively identified with the National Electrical Manufacturers Association, during which time he participated in the work of various committees and sections. He was chairman of the panelboard and distribution board section and of the knife and enclosed switch section. He held the position of NEMA coordinator with the panelboard and distribution board industry under the NRA.

In addition to his active military duties during World War II, on the home front he was a member of WPB advisory committees on switches, busways, and circuit breakers. He was chairman of the OPA on knife and enclosed switches and circuit breakers.

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▶NORMAN C. MACDONALD, who has been vice-president and general manager of the Crosley Distributing Co, New York, since 1945, has been made general sales manager of Crosley Division of the Avco Manufacturing Corp, Cincinnati. Mr MacDonald has had 20 years' experience in the radio and household appliance businesses and for many years served as Eastern regional sales manager for Crosley. SYDNEY D. MAHAN, formerly head of both sales and advertising, will head up an expanded advertising, sales promotion and public relations department. In addition to wide experience with leading national advertising agencies, Mr Mahan spent eight years with Westinghouse as merchandise advertising and promotion manager and general advertising manager. CORLEY W. KIRBY has been appointed domestic sales manager of Crosley. Mr Kirby has served Frigidaire as branch manager in Newark, N. J., sales manager of the New York branch and in various capacities at headquarters in Dayton, Ohio. LEE STRATTON, whom Mr Kirby succeeds, will head up a new section on home freezers. He started with Crosley in 1944.

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I. T. & T. Announces New Executive Appointments

Election of Edward D. Phinney as vice-president of the International Telephone & Telegraph Corp, New York, has been announced. Mr. Phinney, who became associated with I. T. & T. in 1936, has served as the corporation's general patent attorney since 1941 and will continue in that capacity. He is widely known in the patent, engineering and communications fields.

He is also vice-president, general patent attorney and a director of the International Standard Electric Corp and of the Federal Telephone & Radio Corp, both subsidiaries of I. T. & T.

He is a member of the American Institute of Electrical Engineers and the Institute of Radio Engineers.

William Hatton has been appointed director of manufacture of I. T. & T. and the International Standard Electric Corp. In his new position, Mr Hatton, who has been associated with I. T. & T. and its affiliated companies since 1919, assumes, in addition to his present duties as director of engineering, full responsibility for the system-wide coordination and development of manufacturing methods. A vice-president and director of the International Standard Electric Corp, he joined the International Western Electric Co 28 years ago.

The election of Maj. Gen. Roger B. Colton (retired) as vice-president of the Federal Telephone & Radio Corp, has also been announced. General Colton, who has completed more than 30 years of service with the U. S. Army, has had extensive experience in communications research and development.

•

▶PETER J. GORMAN has been appointed traffic manager of the light division of the Noma Electric Corp, New York. Mr Gorman was formerly associated with the War Assets Administration in Linden, N. J., and was traffic manager

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Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

***Crapo* Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.**

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Will not blow over, leaving your men and the public unprotected. Sign frame pivoted on each side allowing movement with varying wind and pressures and full vision at all times.

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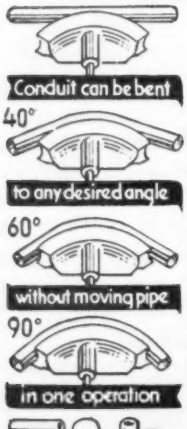

With an easy-to-operate Tal machine, anyone can make perfect, true bends, cold to any radius up to 90° in one single, uninterrupted operation. There is no need to waste time by replacing the conduit three to six times when bending. Thousands are already in use. Write for illustrated data bulletin.

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Department EW-1—Milwaukee 2, Wisconsin

of the Radio Corp of America, tube division, Harrison, N. J. Prior to this connection, he was connected with the Crocker-Wheeler Electric Manufacturing Co in Ampere, N. J., and was assistant traffic manager of the incandescent lamp division of the General Electric Co in Harrison, N. J.

•

▶ W. E. Row, manager of operations for the Southern California Edison Co, has retired from active service after many years with the company. He will be succeeded by C. M. Cavner, assistant manager of operations, who will be acting manager of operations. E. N. Husher, superintendent of distribution, has been made assistant manager of operations. Although Mr Row has been associated with the company since 1908, his continuous service dates from 1926 when he became an engineer in the distribution division. In 1923-24-25 he was on the California Railroad Commission staff. In the subsequent years he became assistant superintendent of distribution, electrical engineer and superintendent of distribution. In 1941 he was made assistant manager of operations, and became manager of operations in 1945, the position he held at the time of his retirement.

▶ E. E. Ellis has been named engineer-in-charge of sales, motor and generator section, of the Allis-Chalmers Manufacturing Co's electrical department. Harry A. Wright has been appointed engineer-in-charge of control sales of the control section of the electrical department. Formerly sales representative in A-C district office in Detroit, Mr Ellis has been with the company since his graduation in 1924 from Bucknell University. Mr Wright has been associated with A-C since 1937. Prior to assuming his present position, he was staff engineer of the control engineering section, and before that an engineer in the switchgear department.

▶ Harry Hudlow, manager of the Big Bend Electric Cooperative at Ritzville, Wash., for the past seven years, has resigned to take over the management of the Franklin County PUD at Pasco, which is buying the properties of the Pacific Power & Light Co. He is being succeeded at Ritzville by Robert Klatt, who has been with the cooperative for the last two years as engineer in operations. Mr Klatt, before serving in the Army during the war, was an engineer with the REA at Spokane, Wash, Mr Hudlow took over management of the cooperative in 1940 when it was still in its formative stage. Under his management the system has grown from 240 to 700 miles, with funds allocated for another 300.

New Vice-Presidents Named by Lake Superior Utility

Appointment of two new vice-presidents and the naming of G. A. Donald as executive vice-president of the Lake Superior District Power Co and the Michigan Gas & Electric Co has been announced.

New vice-presidents include Walter L. Larson, Ashland, and M. E. Juhl, Ironwood, Mich.

In 1920 Mr Donald entered the employ of the Lake Superior District Power Co and was made superintendent of the company's operations at Medford, Wis. Six years later he was transfered to Ishpeming, Mich., as general superintendent of the northern division of the Michigan Gas & Electric Co, general offices of which are also located in Ashland. Remaining in that capacity until 1936, he returned to Ashland as vice-president of the Michigan Gas & Electric Co and the Lake Superior District Power Co.

Mr Juhl has been named vice-president in the operating department. A graduate of the University of Wisconsin, Mr Juhl has held various operating positions with Lake Superior and Michigan Gas. He has been with Lake Superior District Power in Ironwood, Mich., since 1943.

Mr. Larson, Ashland district superintendent since 1936, has been named vice-president in charge of commercial and new business activities. He also has had extensive operating experience with the two utility companies, starting in 1922.

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▶ John Herter of Iola, Kan., has been appointed superintendent of the Red Cloud (Neb.) municipal light and power plant. Paul McDowell, who has been acting superintendent, will be first assistant.

▶ Tommy League has been appointed superintendent of the electric department of North Little Rock, Ark., succeeding Victor H. Beals, who recently resigned. Mr League has been with the Rural Electrification Administration in New Mexico.

▶ Frank R. Kohnstamm, nationally known sales executive who for 25 years was associated with Westinghouse Electric Corp in Cleveland and Mansfield, Ohio, has joined the staff of Jack & Heintz Precision Industries, Inc, Cleveland, Ohio, as general sales manager. Mr Kohnstamm entered upon his career with Westinghouse in 1917. He served as manager of the appliance section, assistant sales manager of the merchandising division and as director of merchandise for the merchandising

division. In 1934 he was placed in full charge of the Westinghouse lighting division in Cleveland as manager of the entire engineering, production and sales operation. He later returned to Mansfield as sales manager of the merchandising division, but resigned in 1942 to become executive vice-president of the Vander Horst Corp of America. Just before joining Jack & Heintz he was associated with the Baldwin Locomotive Works in executive capacities.

OBITUARY

Lucius B. Andrus

Lucius B. Andrus, retired executive of the Public Service Co of Indiana, and engineer widely known in the industry in the Middle West, died on Dec 13 in Indianapolis following a brief illness. He was 72 years old.

Mr Andrus went to Indianapolis in 1917 as vice-president and director of the Merchants Heat & Light Co, after spending 12 years as chief engineer and general superintendent of the Indiana & Michigan Electric Co, at South Bend. From 1917 to 1934 he served as president or vice-president of several central Indiana public utility companies which were gradually acquired and merged to form what is now the Public Service Co of Indiana. To facilitate the coordination of service, he supervised construction of the Dresser power station on the Wabash River, one of central Indiana's principal sources of electrical power.

He was a fellow of the American Institute of Electrical Engineers.

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▶ JOSEPH A. CIVILETT, assistant resident representative of the Westinghouse Electric International Co, East Pittsburgh Works, died on December 16 in New York while on a business trip. He was 52 years old. Mr Civilett had been associated with the Westinghouse company in Pittsburgh since 1923 and was an engineer in the switchgear division in East Pittsburgh until 1945, when he joined the International company.

▶ ALMON V. TAYLOR, division manager for Minnesota Power & Light Co at Little Falls, Minn., died suddenly on December 12. He was 60 years old and a native of New York State. Mr. Taylor was a member of the North Central Electric Association.

▶ CHARLES M. DAVIS, 80, president of the Lynn (Mass.) Storage Battery Co, died at Lynn on Dec. 16. He was the inventor of several types of storage and dry cells.

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For measuring resistance to earth of man-made ground connections, used with generating stations, substations, transmission towers, lightning arresters and machine frames. Grounding for protection . . . for insurance.

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MANUFACTURERS & MARKETS

Permanente, Alcoa Racing for Western Market for Aluminum Wire and Cable

A race to reach the Western and Pacific export market for aluminum wire and cable is underway. Henry J. Kaiser's Permanente Metals Corp and the Aluminum Co of America both have announced plans for construction of plants in the Northwest for aluminum wire, rod and bar production.

Kaiser will locate his plant near Trentwood, Wash., in the vicinity of his present aluminum reduction works, while Alcoa will build adjacent to its Vancouver, Wash., smelting facilities.

Both firms declined to state when construction would start, although engineering on Alcoa's plant is known to be underway, and Kaiser has revealed that market-studies have been in progress for more than six months. It also is known that Kaiser representatives have been in the East negotiating for machinery for wire and cable operation.

Another plant of interest to the electrical field was announced earlier by Kaiser, when he learned that his bid for a German aluminum foil plant had been approved by the State Department. Foil will be used in capacitors, electronic and refrigeration equipment.

Purchase, transportation, import duty, and installation costs for the plant, to be located near Spokane, Wash., will amount to about $1,000,000. Although Kaiser representatives have just gone to Germany to supervise dismantling of the plant, it is expected to be in production next summer.

The operation of all three plants will depend on the power supply in the area at the time they are completed. In commenting on the establishment of these new plants, attracted to the territory by available aluminum, Dr. Paul Raver, Bonneville Power administrator, expressed the hope that a plan could be worked out to provide power.

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Veteran Employees Honored

Eighty employees of Federal Telephone & Radio Corp, Clifton, N. J., aggregating more than 13 centuries of service with the International Telephone & Telegraph Corp system, parent company of Federal, were honored by officials of Federal at a special luncheon, held in honor of system veterans at FTR's Clubhouse, Nutley, N. J. The honored employees totaled 1,345 years of service with the IT&T system, ranged from 10 to 45 years longevity, and included men and women. Heading the list was S.V.C. Scruby, who received the 45-year award. He has seen service with the organization in almost every country in Europe and now is connected with Federal in the development of its Universal telephone switching system.

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Form Benkert and Duer Engineering Company

Announcement has been made of the formation of Benkert and Duer, Inc, to specialize in resistance welding equipment. The new organization will maintain three offices in Columbus 2, Ohio (4820 Olentangy Blvd); Cleveland 14, Ohio (859 Leader Bldg), and Indianapolis, Ind. (325 Bankers Trust Bldg). Louis M. Benkert, who has resigned as general sales manager of Progressive Welder Co to enter the new set-up, and Paul Duer, who has been representing Progressive in western Pennsylvania and eastern Ohio, will make their headquarters in Columbus.

Art Johnson, who has resigned as chief electrical engineer of Progressive, will be in charge of the Indianapolis office, while George Omelianoff, also formerly with Progressive as applications engineer, will be in charge of the Cleveland office.

The new organization will represent Progressive Welder Co exclusively in Ohio (except Toledo), western Pennsylvania, northern Kentucky and West Virginia and most of Indiana.

•

Carrier Sales a Record; Increased Volume Seen

Carrier Corp completed a record fiscal year on October 31 and has budgeted an additional increase in sales volume for the present fiscal year, Cloud Wampler, president, stated in New York recently.

"There is every evidence that there still exists a strong deferred demand for air-conditioning, refrigeration and industrial heating equipment," he said.

"Although an increase in sales volume is budgeted for the present fiscal year, Carrier does not plan to force its

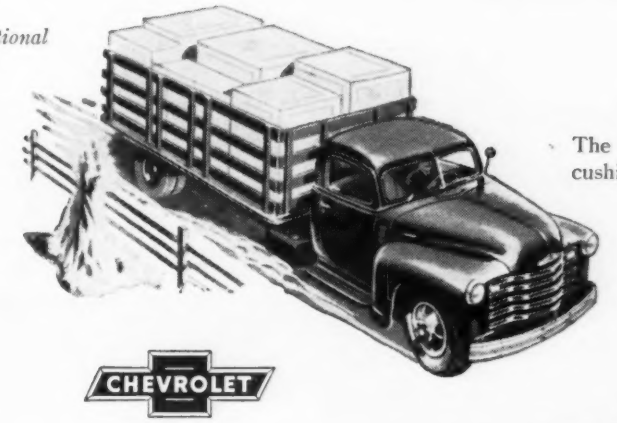
SCIENCE TEACHERS from the Baltimore Public Schools hear Walter Weldon, supervisor of the Fred M. Locke Ceramic Research Laboratory, explain a porcelain manufacturing process. The teachers are studying Baltimore industries

Count on ADVANCE-DESIGN TRUCKS

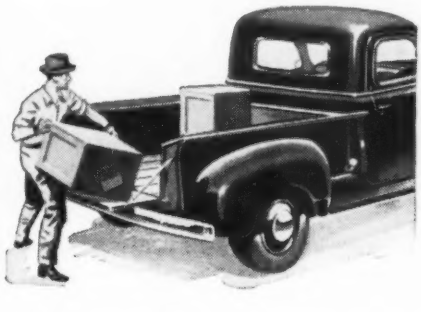
—to cut your costs . . .
—build your business

Chevrolet Advance-Design trucks cost you less—to buy . . . to run . . . to keep! Here is the only truck that provides the comfort of a cab that "breathes"* and other fine, new features that are better for you —and your business!

**Fresh-air heating and ventilating system optional at extra cost.*



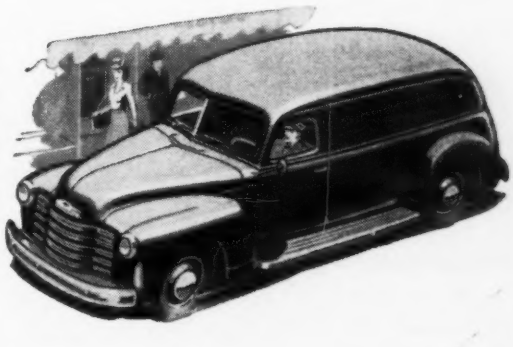
The cab is Flexi-Mounted, cushioned on rubber—with 12 inches more foot room—eight inches more seating space and fully adjustable seat! There's 22% greater visibility, too!

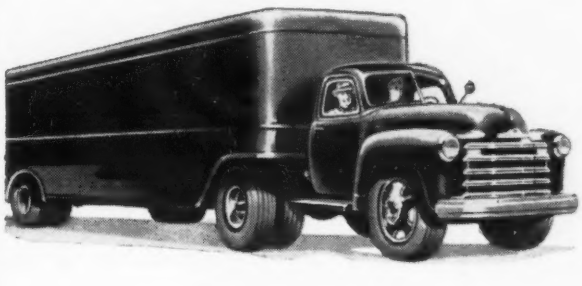


CHEVROLET

Here are stronger new frames, longer wheelbases. New, rear-corner windows, which provide even greater visibility. (Optional at extra cost.) Pick-ups and panels have increased load space.

Streamlined in body, cab, fenders and hood, they're bigger, better-looking with Advance-Design! Chevrolet truck brakes are specially designed for greater brake-lining contact.





Premium power! The Chevrolet Valve-in-Head Truck Engine is the world's most economical for its size. See these trucks today—at your Chevrolet dealer's.

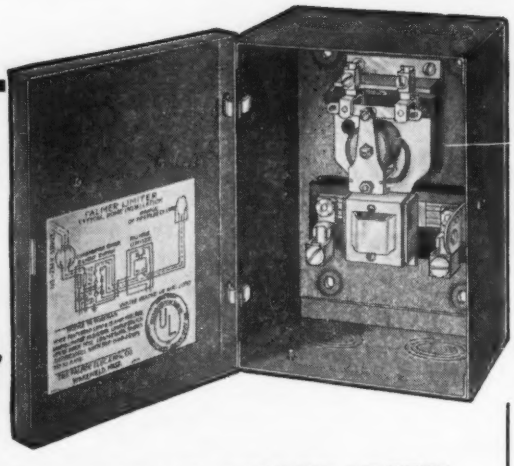
Choose CHEVROLET TRUCKS

FOR TRANSPORTATION UNLIMITED

CHEVROLET MOTOR DIVISION, *General Motors Corporation*, DETROIT 2, MICHIGAN

ELECTRIC POWER ECONOMIES

PALMER LIMITERS



• More and more utilities are turning to the PALMER LIMITER METHOD of controlling electric range and water heater loads. The use of PALMER LIMITERS improves the domestic load factor without increasing the power supply investment.

You cannot afford to neglect this opportunity for extra load dividends. Investigate the PALMER LIMITER.

Listed by Underwriters' Laboratories.

WRITE FOR BULLETIN A-1

PALMER A-A SWITCH

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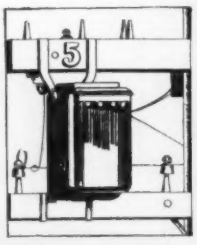
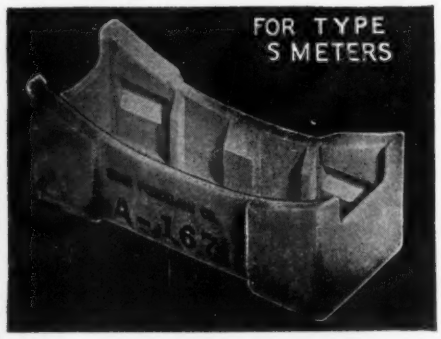
Safety Demands Metal Markers

Positive identification of "hot" lines is permanent with Premax Stamped and Embossed Metal Markers.



Premax Products

DIV. CHISHOLM-RYDER CO., INC.
4818 Highland Ave. Niagara Falls, N. Y.



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Eliminates meter tampering. Cannot be removed without mutilating. SEND FOR SAMPLE.
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finishing cloths flat or formed

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catch cloths

packed in cartons

Select herringbone ticking has no equal

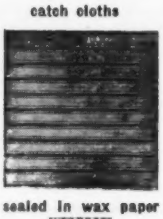
Wiping Surfaces Treated; Ready For Use

REQUIRE NO BREAKING-IN

Wipe Perfect Joints

on lead-sheathed cable splices

Write for literature & prices



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growth. For there are uncertainties, chiefly mounting costs and prices, unbalance due to continuing shortages of critical material, and difficult world conditions. Therefore we plan, in 1948, to devote major attention to consolidating our position, assimilating our new facilities, and bringing inventories into better balance."

•

Sylvania Stops Making Radio Sets at 2 Plants

Sylvania Electric Products, Inc, has closed one of the plants of its subsidiary, Colonial Radio Corp, and will convert another to other work. The closed plant is at Bloomington, Ill. The Riverside, Calif., plant will be converted from the assembling of radio chassis to the manufacture of radio cabinets. Chassis for these cabinets will be shipped from the Buffalo plant.

The plants have been operated at a loss. Although they have been operating at only 30 percent capacity, they have stockpiled 40,000 sets.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs.

WARD LEONARD ELECTRIC Co, Mount Vernon, N. Y., has established a New England office, located at 37 Webster St, Hartford 6, Conn. C. F. Shea, formerly connected with the home office sales engineering department is district manager.

VAN CLEEF BROS, Chicago, has appointed Win Hansen to service North and South Dakota, Iowa, Minnesota, upper Michigan, Wisconsin and certain sections of Illinois. He will make his headquarters in Minneapolis.

JOHN A. ROEBLING'S Sons Co, Trenton, N. J., has named L. H. Van Dike, Jr, as Detroit, Mich., representative, succeeding the late Harry T. Hirbe.

ELECTRICAL ENGINEERS EQUIPMENT Co, Melrose Park, Ill., has appointed Fred W. Knoeppel, 1713 S.W. 9th St, Miami, Fla., as district representative for the State of Florida.

•

New Oil Handling System

A new circuit breaker oil handling system designed to expedite mechanical and electrical tests on oil circuit breakers is being installed at the Allis-Chalmers Boston Works. It will include two 15,000 gallon tanks, piping to service the main assembly and testing floor, and pumps, filters and oil heating equipment.